

EFFECTS OF THE ATOMIC BOMB ON NAGASAKI,
JAPAN

VOL. II

NO. 93

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THE UNITED STATES
STRATEGIC BOMBING SURVEY

EFFECTS OF
THE ATOMIC BOMB
ON
NAGASAKI, JAPAN

~~CONFIDENTIAL~~ 000503

Volume II

Physical Damage Division

JUNE 1947

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THE UNITED STATES
STRATEGIC BOMBING SURVEY

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THE ATOMIC BOMB
ON
NAGASAKI, JAPAN

Volume II

Physical Damage Division

Dates of Survey:

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This report was written primarily for the use of the United States Strategic Bombing Survey in the preparation of further reports of a more comprehensive nature. Any conclusions or opinions expressed in this report must be considered as limited to the specific material covered and as subject to further interpretation in the light of further studies conducted by the Survey.

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FOREWORD

The United States Strategic Bombing Survey was established by the Secretary of War on 3 November 1944, pursuant to a directive from the late President Roosevelt. Its mission was to conduct an impartial and expert study of the effects of our aerial attack on Germany, to be used in connection with air attacks on Japan and to establish a basis for evaluating the importance and potentialities of air power as an instrument of military strategy for planning the future development of the United States armed forces and for determining future economic policies with respect to the national defense. A summary report and some 200 supporting reports containing the findings of the Survey in Germany have been published.

On 15 August 1945, President Truman requested that the Survey conduct a similar study of the effects of all types of air attack in the war against Japan, submitting reports in duplicate to the Secretary of War and to the Secretary of the Navy. The officers of the Survey during its Japanese phase were:

Franklin D'Olier, *Chairman*.

Paul H. Nitze, Henry C. Alexander, *Vice Chairmen*.

Harry L. Bowman,
J. Kenneth Galbraith,
Rensis Likert,
Frank A. McNamee, Jr.,
Fred Searls, Jr.,
Monroe E. Spaght,
Dr. Lewis R. Thompson,
Theodore P. Wright, *Directors*.
Walter Wilds, *Secretary*.

The Survey's complement provided for 300

civilians, 350 officers, and 500 enlisted men. The military segment of the organization was drawn from the Army to the extent of 60 percent, and from the Navy to the extent of 40 percent. Both the Army and the Navy gave the Survey all possible assistance in furnishing men, supplies, transport, and information. The Survey operated from headquarters established in Tokyo early in September 1945, with subheadquarters in Nagoya, Osaka, Hiroshima, and Nagasaki, and with mobile teams operating in other parts of Japan, the islands of the Pacific, and the Asiatic mainland.

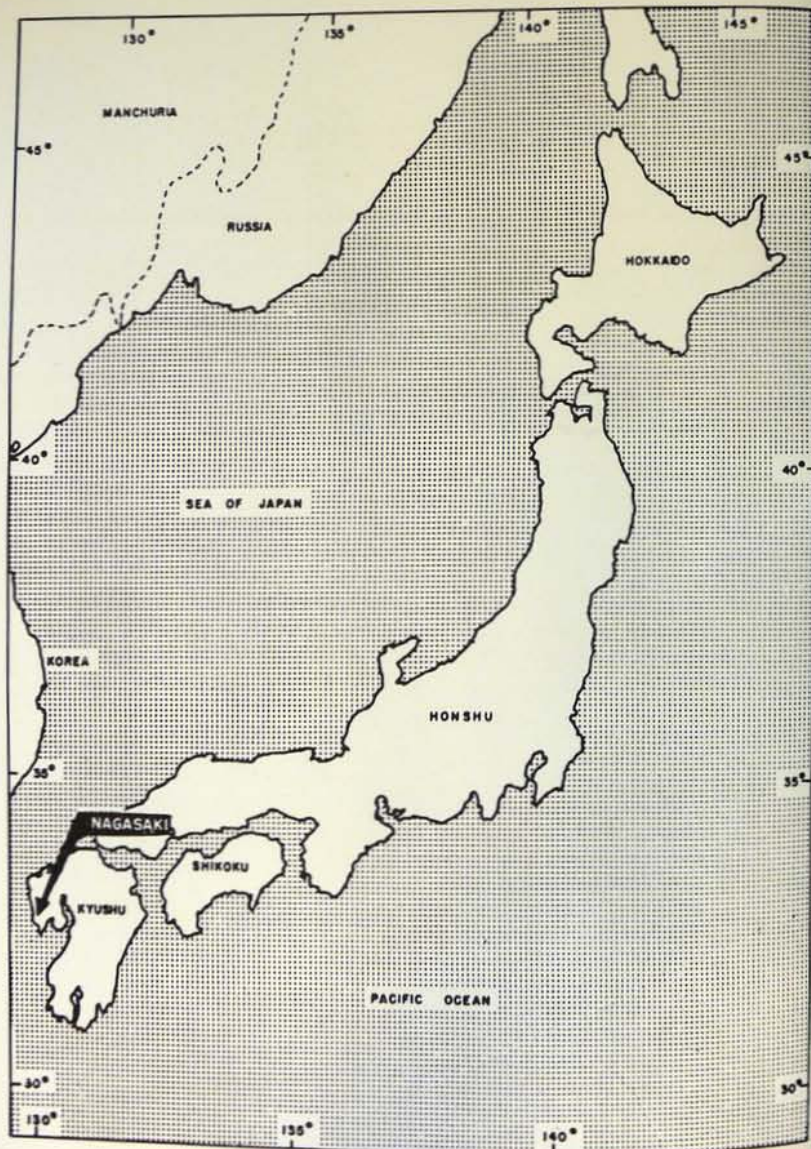
It was possible to reconstruct much of wartime Japanese military planning and execution, engagement by engagement, and campaign by campaign, and to secure reasonably accurate statistics on Japan's economy and war production, plant by plant, and industry by industry. In addition, studies were conducted on Japan's over-all strategic plans and the background of her entry into the war, the internal discussions and negotiations leading to her acceptance of unconditional surrender, the course of health and morale among the civilian population, the effectiveness of the Japanese civilian defense organization, and the effects of the atomic bombs. Separate reports will be issued covering each phase of the study.

The Survey interrogated more than 700 Japanese military, government, and industrial officials. It also recovered and translated many documents which not only have been useful to the Survey, but also will furnish data valuable for other studies. Arrangements have been made to turn over the Survey's files to the Central Intelligence Group, through which they will be available for further examination and distribution.

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Large insert map of Nagasaki (in pocket attached inside of back cover).	



REFERENCE TABLES

TYPES OF DAMAGE

Damage to Buildings, Industrial and Domestic

a. Structural.—Damage to principal load-carrying members (trusses, beams, columns, load-bearing walls, floor slabs in multistory buildings) requiring replacement or external support during repairs. Light members such as purlins and rafters are not included.

b. Superficial.—Damage to purlins and other light members; stripping of roofing and non-load-bearing exterior walls. Damage to glass and interior partitions not included.

Damage to Machinery, Utilities, and Equipment

a. Total.—Not worth repair.

b. Heavy.—Requiring repair beyond capacity of normal maintenance staff, usually returned to manufacturer.

c. Slight.—Requiring repair within capacity of normal maintenance staff.

Damage to Contents Other than Machinery and Equipment

a. Total.—Not usable.

b. Other.—Usable if reprocessed or repaired.

TABLE A. Building types or classifications
(Tables A and B from Joint Target Group)

Group	Type symbol	Description
A. Single-story, no traveling cranes, spans generally less than 75 feet, heights at eaves generally less than 25 feet, area of 10,000 square feet or more.	A1.1	All buildings of this group with saw-tooth roofs other than those included in types A1.2, A1.3, and A1.4.
	A1.2	Frame and roof slab of monolithic reinforced concrete.
	A1.3	Exposed top chords of trusses.
	A1.4	Stressed-skin type of reinforced concrete (e. g., Zeiss Dywidag).
	A2.1	Simple beam and column.
	A2.2	Arches and rigid frames.
	A2.3	Truss construction.
	A2.4	Frame and roof slab of monolithic reinforced concrete.
	A2.5	Stressed-skin type, including concrete shell.
	B1	Buildings containing runways for heavy cranes (capacity 25 tons or more); height at eaves generally more than 30 feet.
B. Single-story with traveling cranes; any length of span; area of 10,000 square feet or more.	B2	All buildings in this group other than those in B1.
	C1.1	Roof trusses supported along 1 side of building by long span trusses and along other side by columns. Permits large door along 1 side and at ends.
	C1.2	Continuous trusses in 1 or 2 directions; long span in 1 direction, supported by columns or exterior walls and by internal columns.
	C1.3	Exposed chord saw-tooth roof buildings; exposed chord trusses supporting major size trusses at 90°. One or both truss systems may be of long span.
	C1.4	Diamond mesh arch.
	C2.1	Long-span arches, individually supported along sides of building. May be arranged in multiple spans joined along side.
	C2.2	Long-span, triangular or bowstring trusses, individually supported by columns at sides of building. May be arranged in multiple spans joined along side, using common columns. Roof pitch exceeds 2 in 10.
	C2.3	Long-span trusses, top chord of pitch 2 in 10 or less, including exposed chord saw-tooth roofs, individually supported by columns along sides of building. May be arranged in multiple spans using common columns or may be continuous over internal columns.
	C3	Stressed-skin, including concrete shell construction.
	D	This type covers all single-story industrial buildings, regardless of type of construction, if under 10,000 square feet in plan area.
C. Single-story; no traveling crane runways; spans greater than 75 feet; height at eaves generally greater than 25 feet; area of 10,000 square feet or more.		
D. All single-story buildings of less than 10,000 square feet plan area.		

Table A—Building types or classifications—Continued

Group	Type symbol	Description
E. Multistory frame buildings	E1	Earthquake-resistant; extremely heavy steel reinforced-concrete, multistory construction, designed to resist heavy lateral loads.
	E2	Structures in this group other than those in E1.
F. Multistory, wallbearing buildings (may have internal columns).	F1	Earthquake-resistant, wall-bearing construction. (Walls of brick, reinforced concrete, or very massive masonry.)
	F2	Structures in this group other than those in F1.
S. Special structures	S	Coke ovens, test cells, fuel storage, boilers in power plants, etc.

TABLE B. HE vulnerability classes

HE vulnerability class	Substructural groups (symbols refer to Table A)
V1.....	E1.
V2.....	B1, B2.
V3.....	E2, F1.
V3A.....	F2.
V4.....	A1.1, A1.2, A1.3, A2.1, A2.2, A2.3, A2.4, D.
V4A.....	C1.2, C1.3, C1.4, C2.3.
V5.....	A1.4, A2.5, C1.1, C2.1, C2.2, C3.

FIRE CLASSIFICATION—BUILDINGS AND CONTENTS

C—Combustible: Buildings whose roofs and/or walls are constructed of combustible material. The floors (except the ground floor) are required to be of similar construction. Wood-frame buildings with noncombustible sheeting on roof and/or walls are also included in "combustible" class.

N—Noncombustible: Buildings which have no significant amount of combustible material in the structure, but whose structure is susceptible to damage by fire in the contents. An example of this type is a building with exposed steel members which may be warped irrepara-

rably by the heat of a fire. Roofs of this type are: Corrugated asbestos, corrugated iron, precast or pour-in-place cement or gypsum on exposed steel, and reinforced concrete 2½-inches thick or less.

R—Fire-resistive: Buildings which have no significant amount of combustible material in the structure and which will withstand all but the most intense fire without structural damage. Roofs and floors (other than ground) should be of concrete more than 2½-inches thick, and the steel frame should be protected and not subject to ordinary fire damage.

C & N, N & R, or C & R used where above types are combined in a single fire division.

Table 1

Type building	Distance from GZ (feet)	Number of buildings	Original floor area	Damaged beyond repair or structure damaged	
				Square feet	Percent
Mixed concrete and steel	3,000-4,000	3	16,000	16,000	100
	4,000-5,000	1	12,000	3,000	25
	5,000-6,000	2	5,000	0	0
	9,000-10,000	1	5,000	0	0
	1,000-2,000	3	39,000	39,000	100
Load-bearing brick-wall	2,000-3,000	1	10,000	10,000	100
	5,000-6,000	2	123,000	123,000	100
	8,000-9,000	1	8,000	0	0
	9,000-10,000	1	9,000	2,000	22
	10,000-11,000	3	81,000	20,000	25
Reinforced-concrete	12,000-13,000	1	7,000	0	0
	13,000-14,000	2	19,000	0	0
	1,000-2,000	16	192,000	110,000	57
	2,000-3,000	16	232,000	23,000	10
	3,000-4,000	2	73,000	36,000	49
Wood-frame	4,000-5,000	2	24,000	12,000	50
	5,000-6,000	1	43,000	0	0
	6,000-7,000	2	32,000	0	0
	8,000-9,000	1	10,000	0	0
	9,000-10,000	1	43,000	0	0
	12,000-13,000	4	72,000	0	0
	0-1,000	11	25,000	25,000	100
	1,000-2,000	94	246,000	246,000	100
	2,000-3,000	27	82,000	82,000	100
	3,000-4,000	10	82,000	82,000	100
	4,000-5,000	24	76,000	76,000	100
	5,000-6,000	12	80,000	79,000	99
	6,000-7,000	5	66,000	66,000	100
	7,000-8,000	3	8,000	8,000	100
	8,000-9,000	10	43,000	33,000	77
	9,000-10,000	1	3,000	3,000	100
	10,000-11,000	12	54,000	32,000	59
	12,000-13,000	1	7,000	0	0

ever, were easily damaged by blast, as, for example, the Urakami Cathedral (Group 15) built of 28-inch brick walls strengthened by buttresses. The walls of another church structure (Group 70) with load-bearing brick walls, situated 8,800 feet from GZ, remained standing, although the interior and the roof were consumed by fire (Table 1).

III GENERAL INFORMATION

1. The actual inspection of the buildings in Nagasaki was made by the following officers:

Capt. L. E. Orin, CE, AUS.
Lt. W. J. Walsh, CEC, USNR.
Lt. P. M. Speake, USNR.

2. The survey was conducted between 14 October

7. Mixed Concrete-and-Steel Buildings. Only seven public buildings with a total floor area of 38,000 square feet and built with concrete walls and columns and steel roof framing were within the area of damage. Four of these buildings were within 5,000 feet of GZ and sustained structural damage. Data concerning these buildings are contained in Table 1.

1945 and 18 November 1945.

3. Information was obtained by visual inspection of the structures. In some cases, Japanese drawings were used as a basis for the drawings included in this report, but in all cases these drawings were checked for accuracy.

IV DAMAGE ANALYSIS

1. The insert map of Nagasaki (in an envelope at the end of this volume) shows 94 principal groups of buildings (other than dwellings), most of which were selected for detailed study.

2. Of these, 38 were nonindustrial groups, which are listed below:

Group	Name	Described in par.
1	Boys' Normal School	4
7	Divinity School	5
8	Yamazato School	6
9	Engineering School	7
10	Nagasaki Commercial School	8
13	Nagasaki Prefecture Prison	9
14	School for Blind and Dumb	10
15	Urakami Cathedral	11
16	Shiroyama School	12
17	Nagasaki Medical College	13
18	Chinzei School	14
19	Urakami Branch, Mitsubishi Hospital	15
20	Nagasaki University Hospital	16
21	Private Mitsubishi Boys' Industrial School	17
22	Mitsubishi Nagasaki Worker's Club	17
23	Keiho Boys' High School	18
27	Fuehi School	19
28	Nagasaki Municipal Crematory	20
29	Nagasaki Hygiene Experimental Center and Hospital for Contagious Diseases	21
32	Zensa School	22
37	Prisoner of War Camp (Saiwai Machi)	23
38	Inasa School	24
42	Nishikara School	25
46	Honren Temple	26
47	Kokuho Fukusai Temple	27
48	Asahi School	28
70	Nakamachi Church	29
72	Funatsu Machi Branch of Mitsubishi Hospital	30
73	Shinkozen School	31
76	Girl's Municipal Commercial School	32
78	District Court and Public Prosecutor's Office	33
79	Regional Court and Public Prosecutor's Office	33
80	Relief Association Office	34
81	Nagasaki Prefectural Office and Court-house	35
83	Main Post Office	36
84	Consulate Office	37
88	Minamioura Grade School	38
91	Tomachi Grade School	38

In general, there will be for any one group:

a. A brief description of the group (supplemented in some cases by a table "Building classification").

b. A plot plan and drawings of the important buildings.

c. "Damage analysis" sheets listing the data for each building.

d. At the end of the part, pertinent photos.

e. Information regarding material tests and building code loads, pressures, and stresses will be found in Paragraph 39, the end of Part 3.

3. Symbols. The system of symbols used in this report to designate industrial buildings according to the types of construction will be found explained in the reference tables in this volume immediately preceding this part.

4. Boys' Normal School, Group 1

a. This group of buildings was situated approximately 5,800 feet north by east from GZ, just west of the Urakami River.

b. It consisted of one three-story, reinforced-concrete building (Building 7), one mixed steel-and-concrete building (Building 7A), and several wood-frame structures of various heights and sizes. The buildings covered a total plan area of approximately 66,800 square feet. Data are on following pages.

c. All of the wood-frame buildings in this group west of the three-story concrete structure (Building 7) were destroyed by blast and fire (Photos 1 and 7); only the foundation wall and piers remained. The fire which consumed these buildings was considered secondary because of the presence of a boiler and cooking equipment in the buildings destroyed. The concrete walls of Building 7 stopped the fire, and the only damage to this building consisted of partly burned wooden window frames in the western portion of the building.

d. The wood-frame building (Building 9) east of the main concrete building was demolished by blast (Photos 4, 5, and 7). One small wooden shed (Building 8) and the wooden roofs over walks in the courtyard sustained superficial damage by blast.

e. The auditorium (Building 7A) sustained superficial damage to the roof, but was structurally undamaged (Photo 3). No fire occurred in this building.

f. The main building of the group (Building 7) sustained only minor atomic bomb damage, consisting of broken glass and plaster. A direct hit by a 500-pound high-explosive bomb on 29 July 1945 caused some damage to the intermediate

Building classification, Group 1

Building No.	Area		Type	Fire class	Construction			
	Plan (square feet)	Total floor (square feet)			Reinforced concrete	Concrete and steel	Load-bearing wall	Wood
1 ¹			D	C				X
2	1,350	1,350	D	C				X
3	2,700	2,700	D	C				X
4	972	972	D	C				X
5	15,030	30,060	E2	C				X
5A	3,900	3,900	D	C				X
6	11,800	11,800	A2.3	C				
7	14,480	43,440	E1	R	X			
7A	4,100	4,100	D	C & N		X		
8 ¹								
8A ²								X
9	12,530	12,530	A2.3	C				
Totals	66,862	110,852			1	1	0	8

¹ No information available.

² Shed—not surveyed.

³ Covered walks—not surveyed.

floor and north exterior wall, but no fires resulted. Damage caused by this bomb is shown in Photos 10 through 13.

g. Light flash burns were noted on telegraph poles and wooden athletic equipment in the vicinity of these buildings. The blackening was confined to the southern half of the poles and the tops of horizontal framing.

h. Fire protection equipment consisted of static tanks and hand pumps.

Damage data, Group 1

Building No.	Occupancy	Fire class	Estimated damage, blast and fire, buildings		Fire, contents
			Superficial	Structural	
2	Bathhouse	C	Total	Total	Total
3	Barracks	C	do	do	Do.
4	Boilerhouse	C	do	do	Do.
5	Classrooms	C	do	do	Do.
5A	do	C	do	do	Do.
6	do	C	do	do	Do.
7	Main school	R	(1)	(1)	Do.
7A	Auditorium	C	(1)	None	
9	Classroom	C	Total	Total	

¹ 100 percent glass; 40 percent plaster.

² Severe structural damage by high-explosive bomb on 29 July 1945.

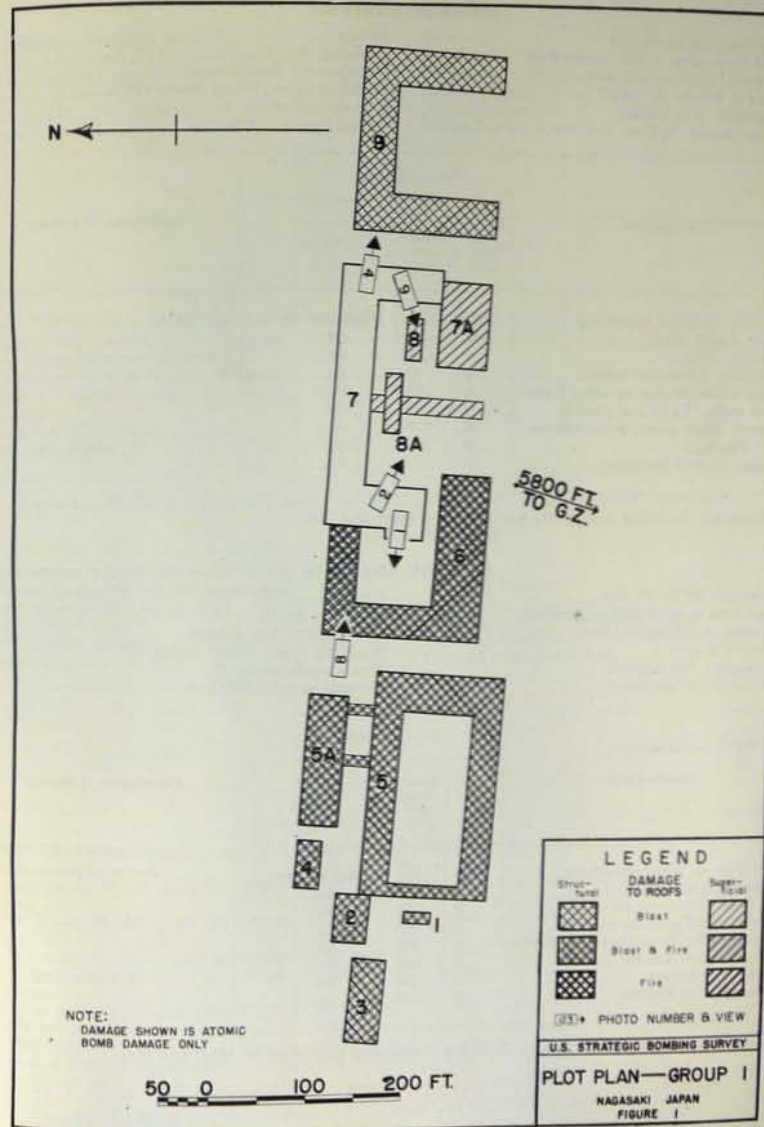
³ 100 percent glass, 100 percent roof tiles.

5. Divinity School, Group 7

a. This group, located 4,800 feet northeast of GZ, consisted of two brick and reinforced-concrete structures used in peacetime as a school (Fig. 2). Having been converted into a hospital, its buildings housed many patients at the time of the attack.

b. The larger structure (Building 1) was a three-story building with a concrete-and-brick frame, brick panel walls, concrete-and-wood floors, concrete columns, beams, and spandrels, composite roof trusses of concrete and wood, and a roof of tile and wood. In general, the walls and structural frame of the building withstood the blast fairly well, and the damage from this source consisted of a few cracks in the main and interior brick walls and damage to roofing and roof trusses. There was considerable fire damage to interior finish and the combustible parts of the roof were completely consumed. Damage is shown in photos 16 through 22.

c. The priest in charge of the school at the time of the attack was questioned regarding the start of the fire in Building 1. According to him, eye witnesses claimed that fire broke out in two widely separated places in the combustible slate-covered roof where blast had blown away much of the slate, and had left the wood roof boards exposed. It spread downward throughout the entire building.



DAMAGE ANALYSIS

Dimensions: 30 by 45 feet.
Ground floor area: 1,350 square feet.
Total area: 1,350 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 50 feet.

Group 1.
Building No. 2.
Occupancy: Bathhouse.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	100	0	Blast and fire	
Trusses: Light wood	100	0	do	
First floor: Tile	0	50	do	
Foundation: Concrete walls	0	10	do	
Exterior walls: Stucco on wood frame	0	100	do	
Interior walls: Lath and plaster	0	100	do	
Windows: Plain glass, wood frames	0	100	do	
Finish: Plaster	0	100	do	
Contents: School furniture	0	100	do	

Remarks: Building completely destroyed by blast and fire.

DAMAGE ANALYSIS

Dimensions: 30 by 90 feet.
Ground floor area: 2,700 square feet.
Total area: 2,700 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 50 feet.

Group 1.
Building No. 3.
Occupancy: Not known.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Light wood	0	100	do	
First floor: Concrete on earth	0	20	do	
Foundation: Concrete walls	0	20	do	
Exterior walls: Stucco on wood frame	0	100	do	
Windows: Not known	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Probable barracks. Building completely destroyed by blast and fire.

DAMAGE ANALYSIS

Dimensions: 18 by 54 feet.
Ground floor area: 972 square feet.
Total area: 972 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 50 feet.

Group 1.
Building No. 4.
Occupancy: Boilerhouse.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	100	0	Blast and fire	
Trusses: Light wood	100	0	do	
First floor: Concrete on earth	20	0	do	
Foundation: Concrete wall and piers	10	0	do	
Exterior walls: Stucco on wood frame	100	0	do	
Windows: Not known	100	0	do	
Contents: Boiler	50	0	do	

Remarks: Building completely destroyed by blast and fire. Concrete stack standing.

DAMAGE ANALYSIS

Dimensions: 110 by 200 feet over all.
Ground floor area: 15,030 square feet.
Total area: 30,060 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 50 feet.

Group 1.
Building No. 5.
Occupancy: Classrooms.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	100	0	Blast and fire	
Trusses: Light wood	100	0	do	
Second floor: Wood floor on wood joist	100	0	do	
First floor: Wood floor on wood joist	100	0	do	
Foundation: Concrete wall and piers	80	0	do	
Exterior walls: Stucco on wood frame	100	0	do	
Interior walls: Lath and plaster	100	0	do	
Windows: Not known	100	0	do	
Finish: Plaster	100	0	do	
Contents: School equipment	100	0	do	

Remarks: Building completely destroyed by blast and fire. Photo 1.

DAMAGE ANALYSIS

Dimensions: 30 by 130 feet.
Ground floor area: 3,900 square feet.
Total area: 3,900 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 50 feet.

Group 1.
Building No. 5-A.
Occupancy: Classrooms.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	100	0	Blast and fire	Photo 1.
Trusses: Light wood	100	0		
First floor: Wood on wood joist	100	0		
Foundation: Concrete walls and piers	50	0		
Exterior walls: Stucco on wood frame	100	0		
Interior walls: Wood and plaster	0	100		
Windows: Not known	0	100		
Finish: Plaster	0	100		
Contents: School furniture	0	100		

Remarks: Building completely destroyed by blast and fire. Photo 1.

DAMAGE ANALYSIS

Dimensions: 175 by 175 feet over all.
Ground floor area: 11,800 square feet.
Total area: 11,800 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 50 feet.

Group 1.
Building No. 6.
Occupancy: Classrooms.
Building type: Wood frame (A2.3).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	100	0		
Trusses: Light wood	100	0		
First floor: Wood floor on wood joist	100	0		
Foundation: Concrete walls and piers	20	0		
Exterior walls: Stucco on wood frame	100	0		
Interior walls: Wood and plaster	0	100		
Windows: Not known	0	100		
Finish: Plaster	0	100		
Contents: School equipment	0	100		

Remarks: Building completely destroyed by blast and fire. Photo 1.

DAMAGE ANALYSIS

Dimensions: 90 by 262 feet over all.
Ground floor area: 14,480 square feet.
Total area: 43,440 square feet.
Number of floors: 3.
Eave height: 40 feet.
Mean elevation: 50 feet.

Group 1.
Building No. 7.
Occupancy: Classrooms.
Building type: (E1).
Fire classification: R.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: 6-inch reinforced concrete slab	0	0		Glass only.
Columns: Reinforced concrete, 16 by 16 feet and 16 by 16 inches	0	0		
Third floor: 6-inch reinforced concrete slab	0	0		
Second floor: 6-inch reinforced concrete slab	0	0		
First floor: 6-inch reinforced concrete slab	0	0		
Foundation: Reinforced concrete	0	0		
Exterior walls: 5½-inch reinforced concrete	0	0		
Interior walls: Wood and plaster	0	0		
Windows: Clear glass wood frames	0	100	Blast	
Finish: Plaster	0	40	do	
Contents: School equipment	0	0		

Remarks: Only damage to window glass by atomic bomb. Severe structural damage on 29 July 1945 by 500-pound high-explosive bomb. Photos 6, 7, 8, 10, 11, 12, and 13.

DAMAGE ANALYSIS

Dimensions: 50 by 82 feet.
Ground floor area: 4,100 square feet.
Total area: 4,100 square feet.
Number of floors: 1
Eave height: 35 feet.
Mean elevation: 50 feet.

Group 1.
Building No. 7A.
Occupancy: Auditorium.
Building type: Concrete and steel frame (D).
Fire classification: C & N.
Ground zero: 5,800 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Tile on wood sheathing and purlins	0	100	Blast	All roofing displaced; Photo 1
Trusses: Light steel	0	0		
Columns: 20- by 20-inch reinforced concrete outside walls	0	0		
First floor: Wood on wood sleepers	0	0		
Foundation: Concrete wall	0	0		
Exterior walls: Reinforced concrete walls between columns	0	0		
Windows: Clear glass wood frames	0	100		Glass broken.
Finish: Wood trim	0	0		
Contents: Not known	0	0		

Remarks: No structural damage to this building. Photos 2 and 3.

DAMAGE ANALYSIS

Dimensions: 175 by 200 feet over all.
Ground floor area: 12,530 square feet.
Total area: 12,530 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 50 feet.

Group 1.
Building No. 9.
Occupancy: Primary classroom.
Building type: Wood frame (A2.3).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Tile on wood sheathing	0	100	Blast	Photos 4 and 5.
Trusses: Light wood	100	0	do	
First floor: Wood floor on wood joist	50	0	do	
Foundation: Concrete walls and piers	10	0		
Exterior walls: Bamboo, mud, and wood frame	100	0		
Windows: Plain glass wood frame		100		
Finish: Wood trim		100		
Contents: School furniture	0	0		

Remarks: Completely demolished by blast; no fire in this building. Photos 4 and 5.

ing, two stairways and an elevator shaft acting as flues or down drafts. The entire contents of the building were destroyed; a collection of 3,000 books burned for 3 days and was ultimately consumed. Persons connected with the school claimed that there was no combustible material in the attic, although there was some wiring and an electrically driven water pump. Witnesses claimed that the electric current failed immediately after the blast so it probably could not have started any fires. The building was remotely located and was not seriously exposed by combustible dwellings. For those reasons it is believed that the fire resulted from a primary source, i. e., the radiant heat of the bomb.

d. Building 2, a single-story structure, was located 23 feet south of Building 1 on a terrace of the hillside. This building had a concrete frame, roof, and floor, and thin brick walls on the south, east, and west sides. The north wall (against the hill) was of concrete and acted as a retaining wall. Fire did not affect this structure, but blast structurally damaged 40 percent of the walls and forced the south wall inward. Windows and finish were 100 percent damaged.

e. Fire protection for the school was provided by one large outside static tank, one hand pump, and casks of water in the corridors. Public fire department equipment probably could not reach the group because of the narrow roads leading to it.

f. Following is the table of fire damage to the group:

Building No.	Occupancy	Fire class	Estimated damage, blast and fire, buildings		Fire contents
			Superficial	Structural	
1.	School	(1)	Total	Moderate	Total
2.	Unknown	N	100 percent windows and finish.	40 percent	Name

¹ M & R 60 percent, C 40 percent.

g. Details of construction and damage in this group are given in Figure 2, in Photos 14 through

22, and in the damage analysis sheets following the figure.

6. Yamazato School, Group 8

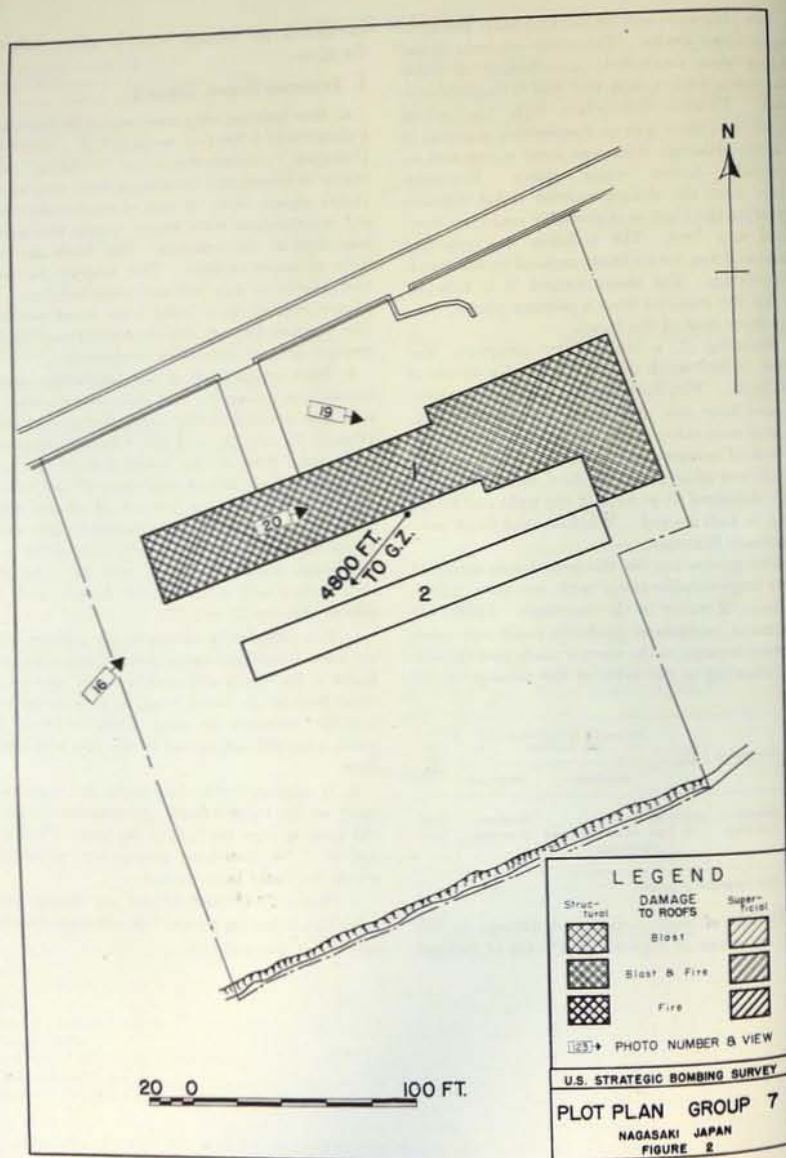
a. One building only was located on this site at a distance of 2,200 feet north of GZ. This was a U-shaped, reinforced-concrete building, three stories in height and covering a total plan area of 14,144 square feet. It was of earthquake-resistant construction with heavy beams and girders launched at the columns. The floors and roof were of concrete slabs. The interior partitions were plaster on wire lath and wood framing. The plaster ceilings were hung from wood stringers. The wooden floors in the classrooms were laid on wooden sleepers imbedded in concrete.

b. Blast cracked all of the reinforced-concrete beams supporting the roof slab, and buckled the roof slab upward in the south and central wings (Photos 28, 29, 30, and 32). Beams supporting the second floor at the north wall of the north wing were also cracked near the wall line, but the wall at this point was not out of plumb (Photo 33). Blast also caused the parapet walls to fail at the flashing line at the north sides of the north and south wings (Photos 31 and 34). All glass was broken and steel window frames were displaced (Photos 25 and 27).

c. Fire completely consumed the ceilings, interior wood frame partitions, flooring and trim on all floors of the south and central wings, and on the third floor of the north wing, as well as the combustible contents in these areas. Fire in the north wing did not spread to the first and second floor.

d. It appeared that fire broke out simultaneously on the various floors, the combustible material igniting from the heat of the bomb (Photos 25 and 30). No open-flame devices were noted from which fire could have started.

e. Photos 23 through 34 and the damage analysis sheet following Figure 3 give further information about this building.



DAMAGE ANALYSIS

Dimensions: 222 by 44 feet.
 Ground floor area: 7,700 square feet.
 Total area: 19,840 square feet.
 Number of floors: 3.
 Eave height: 35 feet.
 Mean elevation: 130 feet.

Group 7.
 Building No. 1.
 Occupancy: School.
 Building type: Brick and concrete (E1).
 Fire classification: C.
 Ground zero: 4,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood		100	Blast and fire	Completely destroyed. Photos 16, 18, 19, 20, 21 and 22.
Trusses: Bottom chord of concrete; all other members of wood.	100		do	Wood completely destroyed.
Columns: Brick and reinforced concrete.	5			Cracks in columns in southwest corner. Photo 16.
Third floor: 6-inch reinforced concrete slab; 18- by 10-inch reinforced concrete beams.	10		Blast	
Second floor: 6-inch reinforced concrete slab; 18- by 14-inch reinforced concrete beams.	10		do	
First floor: 50 percent reinforced concrete slab, 50 percent wood.	40		Blast and fire	Photo 17.
Foundation: Reinforced concrete	100	0		
Exterior walls: 14-inch brick	40		Blast	Southwest corner cracked. Photo 16.
Interior walls: Brick, wood, plaster		90	Blast and fire	Brick wall cracked, wood and plaster walls destroyed by fire.
Windows: Wood sash		100	do	
Finish: Flooring, plaster		100	do	

Remarks: Photos 14, 15, 16, 17, 18, 19, 20, 21, and 22.

DAMAGE ANALYSIS

Dimensions: 200 by 22 feet.
Ground floor area: 4,400 square feet.
Total area: 4,400 square feet.
Number of floors: 1.
Eave height: 12 feet.
Mean elevation: 120 feet.

Group 7.
Building No. 2.
Occupancy: Unknown.
Building type: Brick and concrete (D).
Fire classification: N.
Ground zero: 4,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: 4-inch reinforced concrete slab; 8- by 8-inch reinforced concrete beams.	0	0		Brick wall blown in on floor
Columns: 8- by 8-inch reinforced concrete.	0	0		
First floor: Concrete on earth.	0	0		
Foundation: Reinforced concrete.	0	0		
Exterior walls: North wall 4-inch reinforced concrete; east, west, and south walls 4-inch brick.	40	0	Blast	
Windows: Wood sash.	0	100	do	

DAMAGE ANALYSIS

Dimensions: 189 by 197 feet over-all.
Ground floor area: 14,144 square feet.
Total area: 42,432 square feet.
Number of floors: 3.
Eave height: 42 feet.
Mean elevation: 50 feet.

Group 8.
Building No. 1.
Occupancy: School, classrooms.
Building type: Reinforced concrete (E1).
Fire classification: N.
Ground zero: 2,300 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced concrete slab.	100	0	Blast	All beams supporting roof cracked. Photos 28, 29, and 32.
Columns: Reinforced concrete.	0	0		
Third floor: Reinforced concrete slab.	0	0		
Second floor: Reinforced concrete slab.	20		Blast	Beams supporting second floor cracked at north wall. Photo 33.
First floor: Reinforced concrete slab.	0	0		
Basement: Floor—concrete on earth.	0	0		
Foundation: Reinforced concrete, thickness not available.	0	0		
Exterior walls: Reinforced concrete.	5			Parapet walls cracked at roof line.
Interior walls: Lath and plaster.	0	80	Blast and fire.	
Windows: Plain glass, steel sash.	0	100	do	
Finish: Wood floors, plastered walls and hung ceiling.	0	80	do	
Contents: School furniture and equipment.	80		do	

Remarks: All structural damage by blast. Superficial damage by fire and blast. Photos 23 through 34.

7. Engineering School, Group 9

a. This was a group of wood-frame structures located approximately 2,600 feet north-north-east of GZ. Interrogation of persons in the neighborhood indicated that Buildings 3 and 4 were two stories in height. The others were one story high. All the buildings had connecting covered walks. The total plan area was approximately 3,300 square feet.

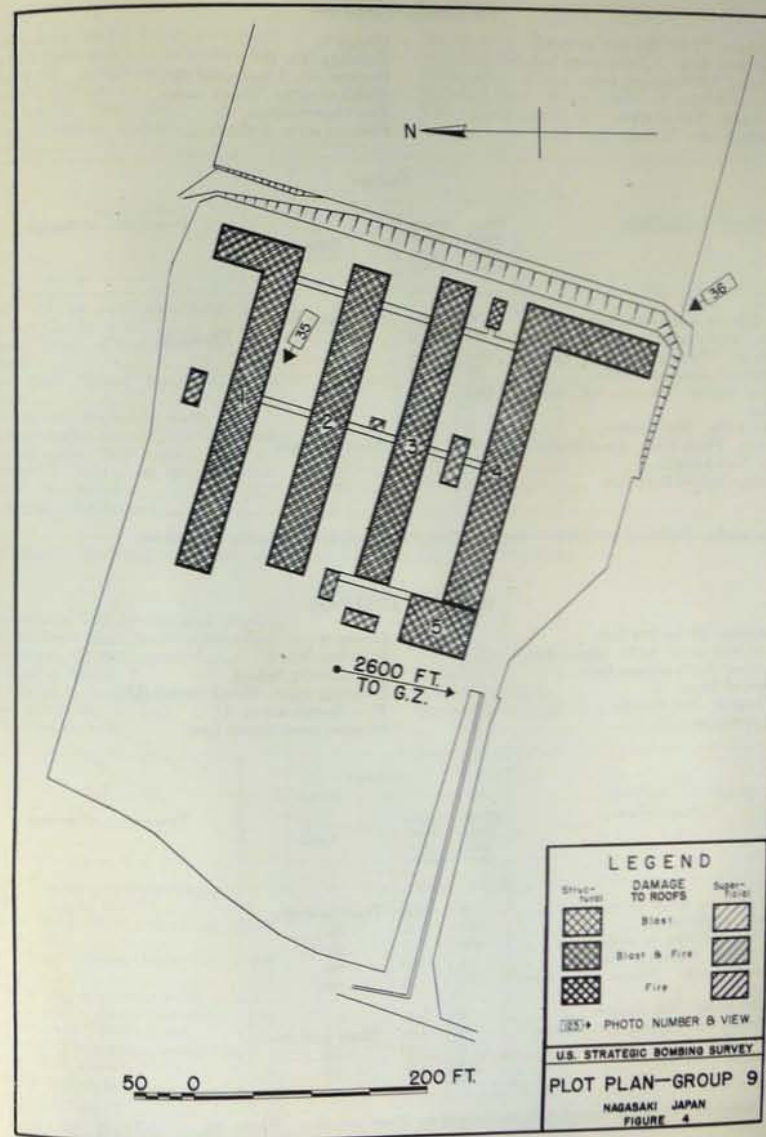
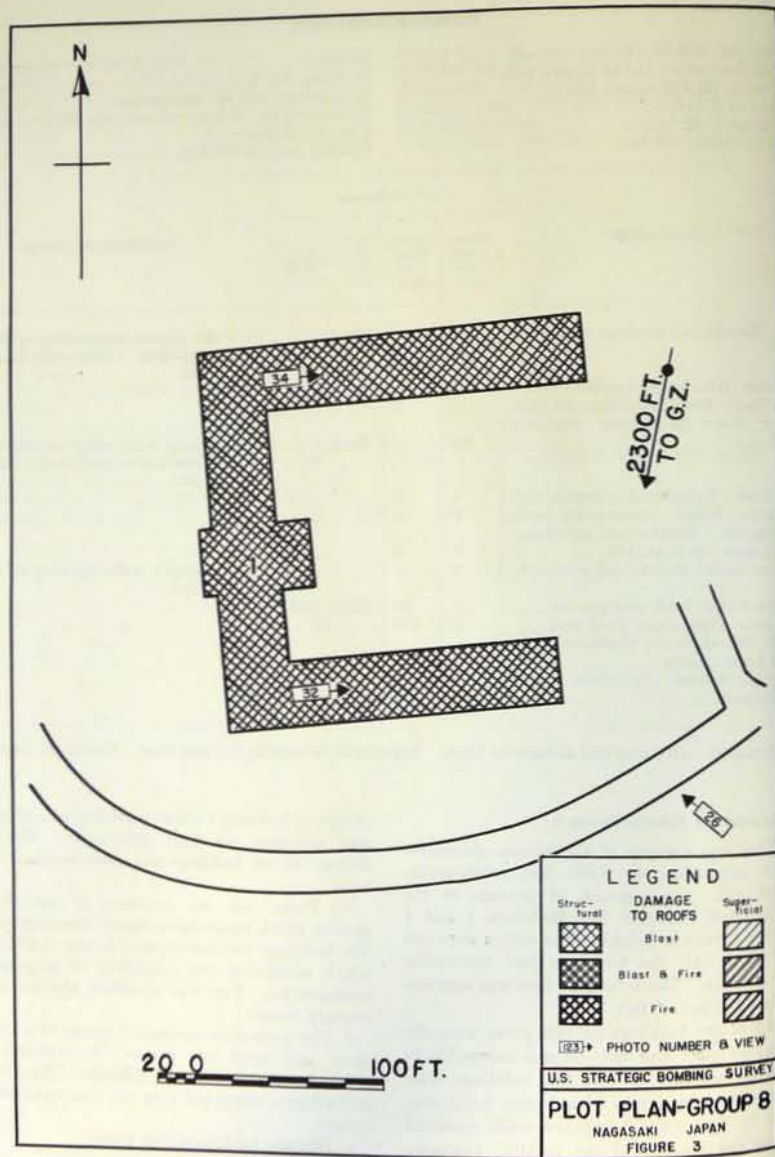
b. All of the buildings in this group were destroyed by blast and fire. It was impossible to determine whether or not the buildings were structurally damaged by blast before being consumed by fire. Only foundation walls remained showing the outlines of the building locations,

except in building 1 where a portion of unburned roof structure remained (Photo 35). The fire damage to all buildings and their contents was total.

(c) There was no evidence of open-flame devices which would have caused secondary fires. The buildings were not exposed to other buildings, which eliminated the possibility of progressive conflagration. Fire was therefore attributed to primary causes.

d. Fire protection equipment consisted of static tanks and hand fire pumps. Accessibility to public fire department was difficult. There were no hydrants connected with the municipal water system.

e. Damage analysis sheets follow.



DAMAGE ANALYSIS

Dimensions: 72 by 284 feet over-all.
Ground floor area: 8,780 square feet.
Total area: 8,780 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 75 feet.

Group 9.
Building No. 1.
Occupancy: Classroom (D).
Building type: Wood frame.
Fire classification: C.
Ground zero: 2,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	Photo 35.
Trusses: Light wood.....	100	0	do.....	
First floor: Wood floor, wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	25	0	do.....	
Exterior walls: Stucco on wood frame.....	100	0	do.....	
Interior walls: Not known.....	0	100	do.....	
Windows: Plain glass, wood frame.....	0	100	Blast and fire.....	
Finish: Not known.....	0	100	do.....	
Contents: School furniture.....	0	100	do.....	

Remarks: Building completely destroyed by blast and fire. Photos 35 and 36.

DAMAGE ANALYSIS

Dimensions: 34 by 264 feet.
Ground floor area: 8,976 square feet.
Total area: 8,976 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 75.

Group 9.
Building No. 2.
Occupancy: School.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	
Trusses: Light wood.....	100	0	do.....	
First floor: Wood on wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	25	0	do.....	
Exterior walls: Stucco on wood frame.....	100	0	do.....	
Interior walls: Not known.....	0	100	do.....	
Windows: Plain glass, wood frame.....	0	100	Blast and fire.....	
Finish: Not known.....	0	100	do.....	
Contents: Not known.....	0	100	do.....	

Remarks: Building completely destroyed by blast and fire. Photo 36.

DAMAGE ANALYSIS

Dimensions: 30 by 282 feet over-all.
Ground floor area: 7,020 square feet.
Total area: 14,040 square feet.
Number of floors: 2.
Eave height: Not known.
Mean elevation: 75 feet.

Group 9.
Building No. 3.
Occupancy: Classrooms.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	
Trusses: Light wood.....	100	0	do.....	
Second floor: Wood floor on wood joist.....	100	0	do.....	
First floor: Wood floor on wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	25	0	do.....	
Exterior walls: Stucco on wood frame.....	100	0	do.....	
Interior walls: Not known.....	0	100	do.....	
Windows: Plain glass, wood frames.....	0	100	do.....	
Finish: Not known.....	0	0	do.....	
Contents: Not known.....	0	100	do.....	

Remarks: Building completely destroyed by blast and fire. Photo 36.

DAMAGE ANALYSIS

Dimensions: 122 by 266 feet over-all.
Ground floor area: 5,928 square feet.
Total area: 11,856 square feet.
Number of floors: 2.
Eave height: Not known.
Mean elevation: 75 feet.

Group 9.
Building No. 4.
Occupancy: Classroom.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	
Trusses: Light wood.....	100	0	do.....	
Second floor: Wood floor on wood joist.....	100	0	do.....	
First floor: Wood floor on wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	25	0	do.....	
Exterior walls: Stucco on wood frame.....	100	0	do.....	
Interior walls: Not known.....	0	100	do.....	
Windows: Plain glass, wood frames.....	0	100	do.....	
Finish: Not known.....	0	100	do.....	
Contents: Not known.....	0	100	do.....	

Remarks: Building completely destroyed by blast and fire. Photo 36.

DAMAGE ANALYSIS

Dimensions: 42 by 60 feet.
Ground floor area: 2,520 square feet.
Total area: 2,520 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 75 feet.

Group 9.
Building No. 5.
Occupancy: Auditorium.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,600 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	
Trusses: Light wood.....	100	0	do.....	
First floor: Wood on wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	25	0	do.....	
Exterior walls: Stucco on wood frame.....	100	0	do.....	
Windows: Not known.....	0	100	do.....	
Contents: Not known.....	0	0	do.....	

Remarks: Building completely destroyed by blast and fire. Photo 36.

8. Nagasaki Commercial School, Group 10

a. This was a group of six buildings located between 3,500 feet and 3,800 feet northwest of GZ as shown in Figure 5. It was composed of one heavily constructed, earthquake-resistant, reinforced-concrete structure (Building 3) with an adjoining shop (Building 3 annex) of concrete-and-steel construction; a separate concrete-and-steel structure (Building 8); and four wooden buildings on concrete foundations (Buildings 1, 5, 6, and 7). The plan area of these buildings was 38,800 square feet. All were damaged by a combination of blast and fire.

b. The main structure (Building 3, Fig. 5, Photos 37, 40, and 48) sustained slight structural and considerable superficial damage. The trim in this building was of wood, and part of the flooring was of wood on sleepers with an air space. All of the combustible material was consumed by fire, and other damage consisted of spalled concrete beams, slabs and walls (Photos 38 and 42). In general, however, more damage was caused by blast than by fire. Of the contents, a number of machine tools were damaged by blast, fire, or a combination of the two.

c. The shop adjoining Building 3 (Building 3 annex) had steel columns and trusses and concrete

walls. The columns were covered with concrete for fire protection, but the trusses were bare. The building suffered considerable structural damage from the blast and fire which also damaged a number of the machine tools. All combustible material in the floor and roof was consumed by fire.

d. Building 8, a machine shop, was another steel-framed structure with concrete panel walls. The roof was of wood, tile covered, and was supported on unprotected steel trusses. It suffered structural damage by blast to the roof trusses, columns and concrete walls. There was also some slight fire damage to the roof boards and to combustible contents of the building.

e. The four wooden buildings were 100 percent damaged by blast and fire. Three of these (Buildings 5, 6, and 7) were used as machine shops and one (Building 1) for miscellaneous storage. There was no evidence of the presence of open flame devices, but Building 7 contained a transformer bank and the oil from ruptured transformers could have become ignited and have resulted in the start of fire which might have spread to Buildings 5, 6, and 8.

f. There was no evidence that fire spread to the fire-resistive building from burning wooden buildings.

g. Fire protection was furnished for the main building by a standpipe and hose connected to the city water supply. There were also several outside static tanks and some hand pumps.

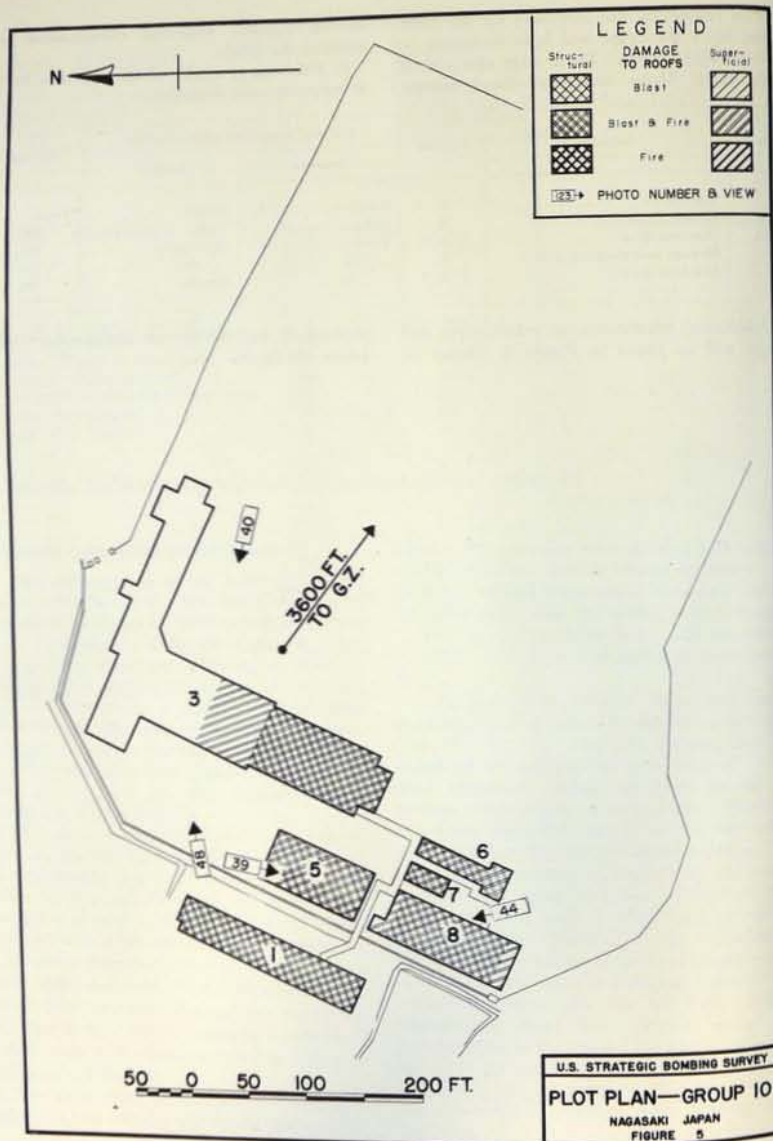
Several 2-gallon soda-acid extinguishers were noted in the debris.

h. Following is a table of fire and blast damage to structures and contents:

Building No.	Occupancy	Fire class	Estimated damage, blast and fire, buildings		Fire, contents
			Superficial	Structural	
1.....	Warehouse.....	C	Total.....	Total.....	Total.....
3.....	School.....	R	Slight.....	None.....	Do.....
3 annex.....	Machine shop.....	C & N	Total.....	Moderate.....	Do.....
5-6-7.....	Storage and machine shop.....	C	do.....	do.....	Do.....
8.....	Machine shop.....	C & N	do.....	Serious.....	Do.....

i. Additional information on construction and damage will be found in Figure 5, Photos 37

through 49, and the damage analysis sheets which follow the figure.



DAMAGE ANALYSIS

Dimensions: 160 by 36 feet.
Ground floor area: 5,800 square feet.
Total area: 5,800 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 70 feet.

Group 10.
Building No. 1.
Occupancy: Warehouse.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 3,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood	0	100	Blast and fire	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Wood	100	0	do	
Foundation: Reinforced concrete				
Exterior walls: Wood	100	0	Blast and fire	
Windows: Wood sash	0	100	do	
Contents: Miscellaneous	0	100		

DAMAGE ANALYSIS

Dimensions: 244 by 171 feet.
Ground floor area: 16,500 square feet.
Total area: 49,500 square feet.
Number of floors: 3.
Eave height: 40 feet.
Mean elevation: 70 feet.

Group 10.
Building No. 3 (main building).
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 3,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: 5-inch reinforced concrete slab on haunched, 25- by 15-inch girders and 19- by 12-inch reinforced-concrete beams.	0	30	Blast and fire	Concrete spalled off beam and girder bottoms. Photo 42.
Columns: 22- by 22-inch reinforced-concrete, bottom story, to 16- by 16-inch reinforced concrete top story.	0	30	do	Concrete spalled off, exposing reinforcing rods.
Third floor: 5-inch reinforced-concrete slab on haunched, 25- by 15-inch beams.	20	60	Fire	Concrete spalled off beams, girders, and slabs, exposing reinforcing rods.
Second floor: Reinforced concrete girders and 19- by 12-inch reinforced-concrete beams.	0	100	do	
First floor: Same as second floor.	0	100	do	Same as second floor.
Exterior walls: 10-inch reinforced concrete.	0	80	Blast and fire	Chipped and spalled.
Interior walls: Reinforced concrete.	0	20	do	do.
Windows: Steel sash.	0	100	do	
Finish: Plaster and wood.	0	100	do	
Contents: Machines on first floor.	0	20	Fire and debris.	

Remarks: Building in good shape structurally. Photos 37, 38, 40, 41, 42, 46, and 48.

DAMAGE ANALYSIS

Dimensions: 102 by 54 feet.
Ground floor area: 5,500 square feet.
Total area: 5,500 square feet.
Number of floors: 1.
Eave height: 25 feet 6 inches.
Mean elevation: 70 feet.

Group 10.
Building No. 3 (Annex).
Occupancy: Machine shop.
Building type: Steel-frame, concrete walls (D).
Fire classification: C.
Ground zero: 3,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood	0	100	Blast and fire	Entirely consumed. Photos 37, 40, 47, and 48.
Trusses: Steel	100	0	do	Distorted due to excessive heat.
Columns: Steel with concrete fireproofing.	0	50	do	Spalled concrete.
First floor: Wood	100	0	Fire	Consumed.
Foundation: Reinforced concrete.	0	0		
Exterior walls: 9-inch reinforced concrete.	0	50	Blast and fire	Spalled concrete.
Windows: Steel sash	0	100	do	
Finish: Wood and plaster	0	100	do	
Contents: Machine tools	0	25	do	

Remarks: Photos 37, 40, 47, and 48.

DAMAGE ANALYSIS

Dimensions: Building 5, 82 by 45 feet; Building 6, 82 by 30 feet; Building 7, 38 by 17 feet.
Ground floor area: 6,000 square feet.
Total area: 6,000 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 70 feet.

Group 10.
Building Nos. 5, 6, and 7.
Occupancy: Machine shops.
Building type: Wood on concrete foundation.
Fire classification: C.
Ground zero: 3,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood	0	100	Blast and fire	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Reinforced concrete	0	0		
Foundation: Reinforced concrete	0	0		
Windows: Wood sash	0	100	Fire	
Contents: Small machines	0	100	do	

Remarks: Buildings completely consumed.

DAMAGE ANALYSIS

Dimensions: 115 by 44 feet.
Ground floor area: 5,000 square feet.
Total area: 5,000 square feet.
Number of floors: 1.
Eave height: 15 feet.
Mean elevation: 70 feet.

Group 10.
Building No. 8.
Occupancy: Machine shop (D).
Building type: Steel-frame, concrete walls.
Fire classification: C.
Ground zero: 3,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	Completely demolished. Photos 39, 43, and 45.
Trusses: Steel	80	0	Blast	Trusses crippled down. Photos 43 and 45.
Columns: Steel	60	0	do	Photo 43.
First floor: Reinforced concrete	0	0		
Foundation: 12-inch reinforced-concrete wall on spread footing	5	10	Blast	Crack in walls and spalled stucco.
Exterior walls: 8-inch reinforced-concrete walls	80	0	do	Building racked, east and west walls failed.
Interior walls: 5-inch reinforced-concrete wall	0	20	Blast and fire	
Windows: Steel sash	0	100	do	Frames destroyed.
Contents: Lathes	0	100	do	

Remarks: Building racked to west; combustible material burned. Photos 39, 43, 44, 45, and 49.

9. Nagasaki Prefecture Prison, Group 13

a. This group of 13 buildings was located approximately 1,000 feet north of GZ on a hill approximately 60 feet above sea level. The prison buildings were surrounded by a reinforced-concrete wall 16 feet in height.

b. The buildings were of wood-frame construction and connected by roofed-over walkways. The cell block (eight buildings numbered 1 on the plot plan, Fig. 6) was constructed of heavy timber-framed roofs and wood-framed walls covered with cement stucco. Building 2 was the only two-story building in the group. Building 4 was an underground cell with only the timber roof above the grade line. The buildings covered a total area of approximately 26,000 square feet. Specific areas and types are as follows:

c. All of the buildings in this group were destroyed by blast and fire. Only the foundation walls, the concrete walk and corridors, concrete stack, and a concrete water tank near Building 2 remained.

d. Since there were no dwellings in the site area from which fire might have spread, and the prison's location on a hill formed an effective barrier against exposure fires, it is probable that the cause of the fire was primary—radiant heat from the atomic bomb. No flash burns, however, were observed on the concrete.

e. No data could be obtained regarding fire protection, but several small static tanks were noted.

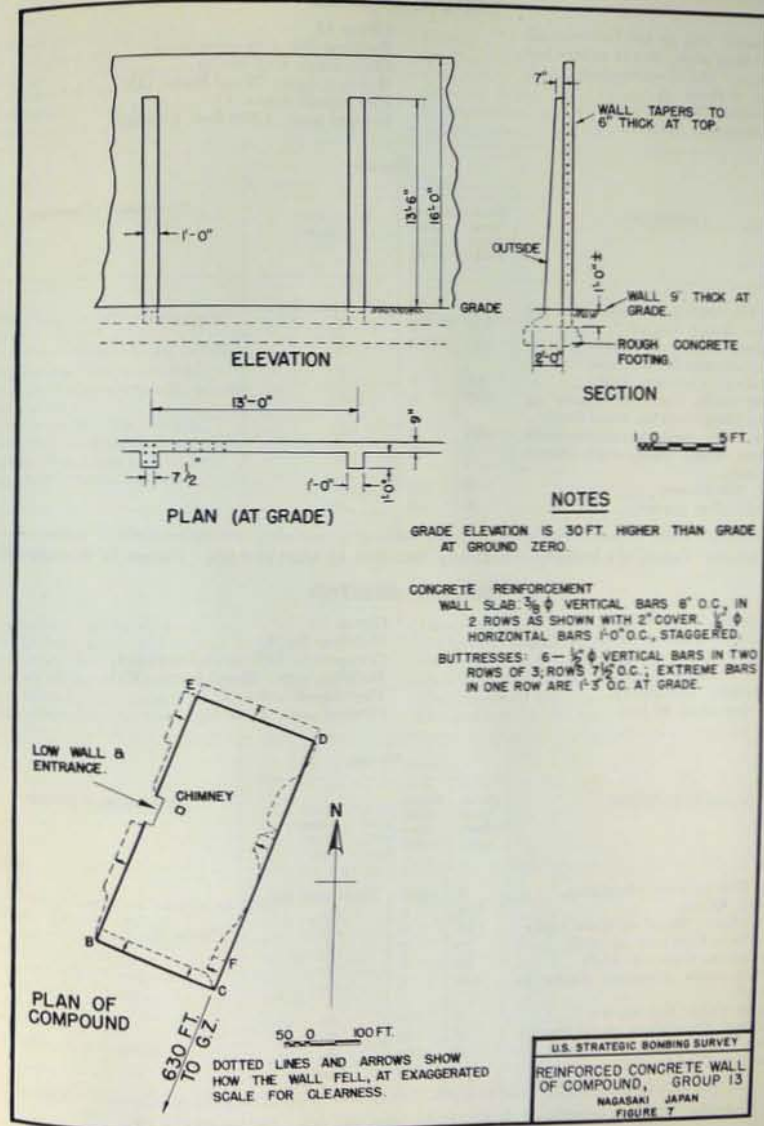
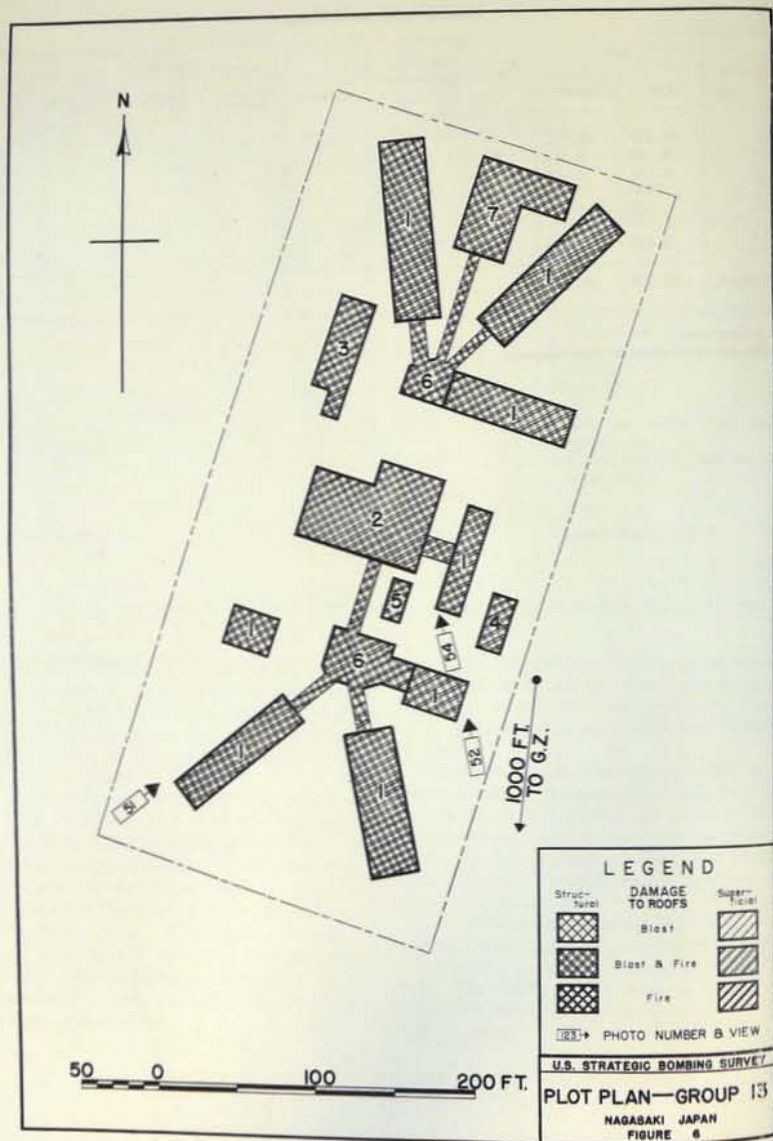
f. Figure 7 shows some details of the concrete wall. The results of tests made on concrete and reinforcing rods from this wall are given in Volume 1 of the report.

Building classification, Group 13

Building No.	Area		Type	Fire class	Construction				
	Plan	Total floor			Steel frame	Reinforced concrete	Concrete and steel	Load-bearing wall	Wood
1	16,472	16,472	D	C	(1)	(1)	(1)		X
2	4,136	8,272	E2	C					X
3	1,533	1,533	D	C					X
4	800	800	D	C					X
5	450	450	D	C					X
6 [†]									
7	2,610	2,610	D	C					X
Total	26,001	30,137							6

[†] 8 structures.

[‡] Roofed open walks and passageways.



DAMAGE ANALYSIS

Dimensions: 180 by 440 feet over-all.
Ground floor area: 16,472 square feet.
Total area: 16,472 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 60 feet.

Group 13.
Building No. 1 (8 structures).
Occupancy: Cell blocks.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,000 feet, average.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile roofing on wood sheathing	0	100	Blast and fire	Photo 50.
Trusses: Heavy timber	100	0	do	
First floor: Wood on timber joist in cells, concrete in corridors	100	0	do	
Foundation: Concrete walls	50	0	do	
Exterior walls: Concrete plaster on heavy metal lath on wood frame	100	0	do	
Interior walls: Same as exterior walls	100	0	do	
Windows: Plain glass, steel frames and bars	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Group of 8 buildings completely destroyed by blast and fire. Photos 51 through 55.

DAMAGE ANALYSIS

Dimensions: 24 by 80 feet.
Ground floor area: 4,136 square feet.
Total area: 8,272 square feet.
Number of floors: 2.
Eave height: Not known.
Mean elevation: 60 feet.

Group 13.
Building No. 2.
Occupancy: Offices and supplies.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 1,100 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	Photo 50.
Trusses: Wood	100	0	do	
Second floor: Wood on wood joist	100	0	do	
First floor: Concrete on earth	10	0	do	
Foundation: Concrete walls	10	0	do	
Exterior walls: Concrete plaster on metal	100	0	do	
Interior walls: Not known	0	100	do	
Windows: Plain glass, metal frames	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Building completely destroyed by blast and fire. Photos 50 and 54.

DAMAGE ANALYSIS

Dimensions: 21 by 78 feet over-all.
Ground floor area: 1,533 square feet.
Total area: 1,533 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 60 feet.

Group 13.
Building No. 3.
Occupancy: Boiler room.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,100 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0	do	
First floor: Concrete on earth	10	0	do	
Foundation: Concrete wall	10	0	do	
Exterior walls: Concrete plaster on metal lath	100	0	do	
Interior walls: Not known	0	100	do	
Windows: Not known	0	100	do	
Finish: Not known	0	100	do	
Contents: Steam boilers	90	10	do	

Remarks: Building completely destroyed by blast and fire. Only reinforced concrete stack remained standing.

DAMAGE ANALYSIS

Dimensions: 20 by 40 feet.
Ground floor area: 800 square feet.
Total area: 800 square feet.
Number of floors: 1 (underground).
Eave height: Not known.
Mean elevation: 60 feet.

Group 13.
Building No. 4.
Occupancy: Execution cell.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,000 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile roofing on wood sheathing	0	0	Blast and fire	
Trusses: Heavy timber	100	0	do	
Basement: Concrete walls and floor	0	0		
Foundation: Concrete	0	0		
Exterior walls: Concrete	0	0		
Interior walls: None				
Windows: None				
Finish: None				
Contents: Not known	0	100		

Remarks: Underground cell with only wooden roof above grade. Roof consumed by fire.

DAMAGE ANALYSIS

Dimensions: 15 by 30 feet.
Ground floor area: 450 square feet.
Total area: 450 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 60 feet.

Group 13.
Building No. 5.
Occupancy: Store house.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,000 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile roofing on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0	do	
First Floor: Wood on wood joist	100	0	do	
Foundation: Concrete walls	25	0	do	
Exterior walls: Concrete plaster on metal lath	100	0	do	
Interior walls: Not known	0	100	do	
Windows: Not known	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Building completely destroyed by blast and fire.

DAMAGE ANALYSIS

Dimensions: 60 by 62 feet over-all.
Ground floor area: 2,610 square feet.
Total area: 2,610 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 60 feet.

Group 13.
Building No. 7.
Occupancy: Work shop.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,200 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0	do	
First floor: Wood on wood joist	100	0	do	
Foundation: Concrete walls	10	0	do	
Exterior walls: Concrete plaster on metal lath	100	0	do	
Interior walls: Not known	0	100	do	
Windows: Plain glass, metal frames and bars	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known, machinery removed	0	100	do	

Remarks: Building completely destroyed by blast and fire.

10. School for Blind and Dumb, Group 14

a. This group of five buildings was situated approximately 1,900 feet northeast of GZ. It consisted of one three-story, reinforced-concrete, and four one-story, wood-frame buildings. The total plan area was approximately 12,500 square feet.

b. The principal building (Building 1) was constructed of reinforced concrete with a timber truss roof. The floor and roof beams were haunched at the column lines (Photos 66 and 70) for lateral stiffening. During the course of the war all interior partition walls, wood trim and wood flooring were removed in order to convert the school building into a light machine shop. Machines were also installed in one of the wood-frame structures (Building 3).

c. The damage to all the buildings was severe. The blast canted Building 1 in a northerly direction, fracturing almost all the columns between the first and third floors. Above the third floor there were no intermediate columns, the wood roof truss spanned the entire width of the building. The columns on the north and south walls above the third floor line failed completely and sections

of these walls collapsed onto the third floor and to the ground below. The extent of structural damage to beams and columns in Building 1 is shown graphically and by means of tables in Figure 9. Photos 56, 57, and 59 through 72 show the extent of damage to the building.

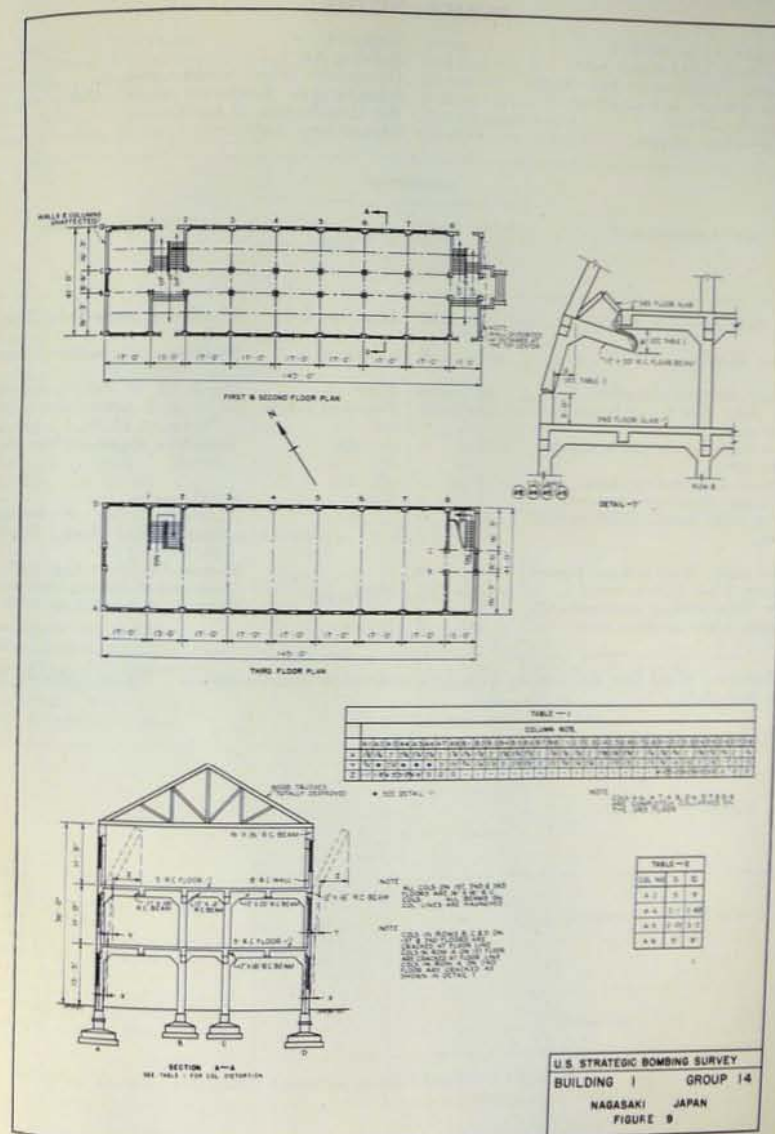
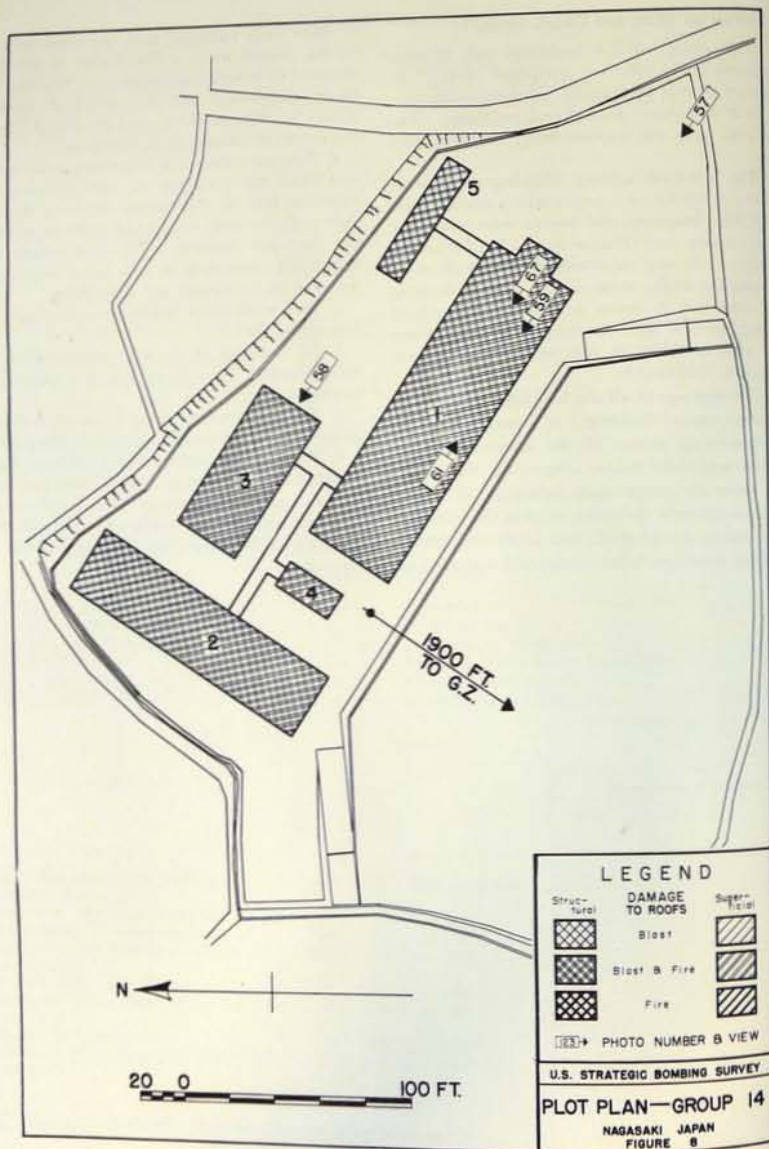
d. Fire was confined in Building 1 to the second and third floors and to the roof structure. It appeared that the fire started either on the third floor or in the roof, and spread to the second floor via the open stairway. The roof trusses were completely consumed, as well as all combustible material on the second and third floors.

e. The wood-frame buildings were totally destroyed by fire.

f. All instances of fire were attributed to primary causes. The group was not exposed by dwellings.

g. Fire-protection equipment consisted of small static tanks, hand pumps, and a few extinguishers.

h. The damage analysis sheets following Figure 9 and Photos 56 through 72 give additional information regarding this group. The results of tests made on concrete and reinforcing steel rods from the walls of Building 1 are given in Volume 1 of this report.



DAMAGE ANALYSIS

Dimensions: 41 by 145 feet.
Ground floor: 5,945 square feet.
Total area: 17,835 square feet.
Number of floors: 3.
Eave height: 36 feet.
Mean elevation: 80 feet.

Group 14.
Building No. 1.
Occupancy: School machine shop.
Building type: Reinforced concrete (E2).
Fire classification: R and C.
Ground zero: 1,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Slate roofing on wood	0	100	Blast and fire	All roofing destroyed. Photo 59.
Trusses: Wood	100	0	do	All trusses collapsed and burned. Photo 56.
Columns: Reinforced concrete	90	0	Blast	Photos 62, 65, 66, 68, and 69.
Third floor: 5-inch reinforced-concrete slab.	50	0	Blast and debris	Slabs and beams fractured. Photos 61, 65, 67, 71, and 72.
Second floor: 5-inch reinforced-concrete slab.	10	0	do	Slabs and beams slightly fractured.
First floor: Concrete on earth.	10	0	do	Slight cracks.
Foundation: Reinforced concrete	5	0	Blast	Greatest degree of damage above third floor. Photos 56, 59, and 62.
Exterior walls: 8-inch reinforced concrete.	80	0	do	Removed before 9 Aug. 1945.
Interior walls: Wood lath and plaster.	0	0		Glass broken, frames destroyed.
Windows: Clear glass in wood.	0	100	Blast	Removed before 9 Aug. 1945.
Finish: Wood flooring; plastered walls.	0	0		
Contents: Light machine tools	0	5	Debris	

Remarks: Wood floor and interior walls were removed to install machines. Figure 9; Photos 56, 57, 59 through 72.

DAMAGE ANALYSIS

Dimensions: 30 by 116 feet.
Ground floor area: 3,480 square feet.
Total area: 3,480 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 80 feet.

Group 14.
Building No. 2.
Occupancy: School.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0	do	
First floor: Wood floor and joists	100	0	Fire	
Foundation: Reinforced-concrete walls and piers	50	0	Blast	
Exterior walls: Wood	100	0	Blast and fire	
Interior walls: Not known	0	100	do	
Windows: No details available	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Building completely destroyed by blast and fire.

DAMAGE ANALYSIS

Dimensions: 30 by 69 feet.
Ground floor area: 2,070 square feet.
Total area: 2,070 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 80 feet.

Group 14.
Building No. 3.
Occupancy: Machine shop (school).
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	100	0	Blast and fire	Remains shown in Photo 58.
Trusses: Wood	100	0	do	
First floor: Wood floor and joist	100	0	do	
Foundation: Reinforced-concrete walls and piers	25	0	do	
Exterior walls: Wood	100	0	do	Photo 58.
Windows: No details available	0	0		
Contents: Light machine tools	0	0		

Remarks: Building completely destroyed by blast and fire. Photo 58.

DAMAGE ANALYSIS

Dimensions: 14 by 30 feet.
Ground floor area: 420 square feet.
Total area: 420 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 80 feet.

Group 14.
Building No. 4.
Occupancy: Lavatory.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	
Trusses: Wood.....	100	0	do.....	
First floor: Wood floor on wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	50	0	Blast.....	
Exterior walls: Wood.....	100	0	Blast and fire.....	
Interior walls: Not known.....	0	100	do.....	
Windows: Not known.....	0	100	do.....	
Finish: Not known.....	0	100	do.....	
Contents: Not known.....	0	100	do.....	

Remarks: Building completely destroyed by blast and fire.

DAMAGE ANALYSIS

Dimensions: 10 by 60 feet.
Ground floor area: 600 square feet.
Total area: 600 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 80 feet.

Group 14.
Building No. 5.
Occupancy: Lavatory.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire.....	
Trusses: Wood.....	100	0	do.....	
First floor: Wood floor on wood joist.....	100	0	do.....	
Foundation: Concrete walls.....	50	0	Blast.....	
Exterior walls: Wood.....	100	0	Blast and fire.....	
Interior walls: Not known.....	0	100	do.....	
Windows: Not known.....	0	100	do.....	
Finish: Not known.....	0	100	do.....	
Contents: Not known.....	0	100	do.....	

Remarks: Building completely destroyed by blast and fire.

11. Urakami Cathedral, Group 15

a. There were four buildings in this group: the cathedral, a school, and two completely demolished buildings, one of which was a chapel. The identity of the other could not be determined. The plan area was 39,670 square feet. The boundary limits of this group were 1,800 feet and 2,200 feet northeast of GZ. The location is shown in Figure 10.

b. The cathedral, Building 1 (Photos 73 through 81) was the largest Catholic church in Japan. It was constructed for the most part of brick and stone. The roof was of tile on wood, carried on wood trusses, and concrete piers. It had massive load-bearing walls, buttressed in the conventional manner of this type of structure. Two towers, each capped by a concrete dome approximately 24 feet square at the base, were located at the west end of the structure, one on each side of the entrance. This building was completely demolished by blast. One of the domes fell into what had been the interior of the building, and the other was blown to the northeast, rolling down a steep embankment into a near-by stream. Fire consumed all the combustible material in the roof and floor.

c. Building 3, the parochial school which had been used as a kindergarten, was constructed of brick and reinforced concrete (Photos 82 and 83) and was 2½ stories high. The roof trusses and part of the flooring were of wood, and the roof was tile-covered wood. Although the building

remained standing after the blast, it was distorted in a westerly direction, causing failures of walls and concrete members. All combustible materials in the structure were consumed by fire.

d. Buildings 2 and 4 were of wood-frame construction and both were completely destroyed by blast and fire. The foundations, all that remain of the buildings, are shown in Photos 75 and 83.

e. None of these buildings was exposed by dwellings, and no open flame devices were noted in the debris. It was therefore concluded that the fires resulted from primary causes.

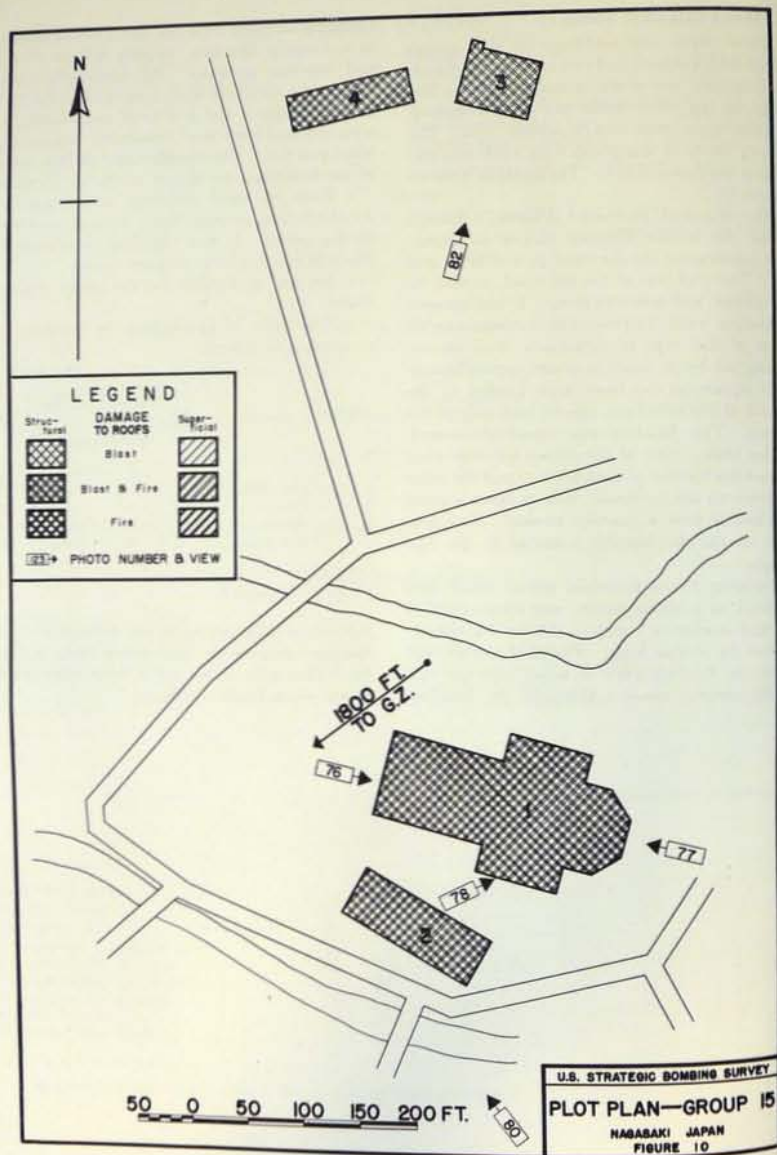
f. No fire protection for the group could be found.

g. The table of fire damage to buildings and contents is as follows:

Building No.	Occupancy	Fire class	Estimated damage, blast and fire buildings		Fire contents
			Superficial	Structural	
1.....	Cathedral.....	C	Total.....	Total.....	Total.....
2.....	Chapel.....	C	do.....	do.....	Do.....
3.....	School.....	(?)	do.....	Serious.....	Do.....
4.....	Not known.....	C	do.....	Total.....	Do.....

¹ Roof C, balance R.

Additional information on the structures and the damage sustained by them will be found in Figure 10, in Photos 73 and 83, and in the damage analysis sheets which follow the figure.



DAMAGE ANALYSIS

Dimensions: 215 by 126 feet.
 Ground floor area: 27,100 square feet.
 Total area: 27,100 square feet.
 Number of floors: 1 (possibly Choir also).
 Eave height: 40 feet.
 Mean elevation: 70 feet.

Group 15.
 Building No. 1.
 Occupancy: Cathedral.
 Building type: Same (F1).
 Fire classification: C.
 Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	Completely destroyed.
Trusses: Wood	100	0	do	do.
First floor: Wood	100	0	do	do.
Foundation: Stone	85	0	do	Completely destroyed. Photos 78 and 79.
Exterior walls: 28-inch brick with buttresses.	100	0	do	
Windows: Wood sash	0	100	do	
Finish: Wood, plaster, stone	0	100	do	

Remarks: Photos 73, 74, 75, 76, 77, 78, 79, 80, and 81.

DAMAGE ANALYSIS

Dimensions: 125 by 45 feet.
 Ground floor area: 5,600 square feet.
 Total area: 5,600 square feet.
 Number of floors: Not known.
 Eave height: Not known.
 Mean elevation: 70 feet.

Group 15.
 Building No. 2.
 Occupancy: Possibly chapel.
 Building type: Wood frame (D).
 Fire classification: C.
 Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Possibly tile on wood	0	100	Blast and fire	
First floor: Wood	100	0	do	
Foundation: Brick and stone	100	0	do	
Exterior walls: Wood	100	0	do	
Windows: Window sash	0	100	do	

Remarks: Buildings completely demolished by blast and fire.

DAMAGE ANALYSIS

Dimensions: 65 by 58 feet.
Ground floor area: 3,450 square feet.
Total area: 10,000 square feet.
Number of floors: 3.
Eave height: 27 feet.
Mean elevation: 70 feet.

Group 15.
Building No. 3.
Occupancy: School.
Building type: Concrete frame, brick walls (E2).
Fire classification: C.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	Completely destroyed. Photos 82 and 83.
Trusses: Wood	100	0	do	Superstructure sheared between first and second floors.
Columns: 10- by 12-inch reinforced concrete.	95	0	do	
Third floor: 4-inch reinforced-concrete slab on 8- by 14-inch reinforced-concrete beams.	5	0	do	
Second floor: 4-inch reinforced-concrete slab on 8- by 14-inch reinforced-concrete beams.	5	0	do	Superstructure sheared between first and second floors.
First floor: 3-inch reinforced concrete on 18- by 24-inch T beams.	90	0	do	
Foundation: 12-inch reinforced concrete.	5	0	do	
Exterior walls: 12-inch brick	95	0	do	
Interior walls: Brick, also plaster	0	100	do	
Windows: Wood sash	0	100	do	
Finish: Wood and plaster	0	100	do	

Remarks: Photos 75, 82, and 83.

DAMAGE ANALYSIS

Dimensions: 110 by 32 feet.
Ground floor area: 3,520 square feet.
Total area: 3,520 square feet.
Number of floors: Not known.
Eave height: Not known.
Mean elevation: 70 feet.

Group 15.
Building No. 4.
Occupancy: Unknown.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Wood	100	0	do	
Foundation: Reinforced concrete	80	0	do	
Exterior walls: Wood	100	0	do	
Interior walls: Wood	0	100	do	
Windows: Wood sash	0	100	do	
Finish: Wood	0	100	do	

Remarks: Building completely demolished. Photo 83.

12. Shiroyama School, Group 16

a. This group consisted of two three-story, reinforced-concrete buildings, situated approximately 1,700 feet west of GZ on a hill approximately 80 feet above sea level. They were of earthquake-resistant design, constructed with heavy columns and girders. Building 1 was laid out roughly in the shape of the letter "Z". Building 2 was rectangular in shape with two additions to the north containing stairways. The total plan area was approximately 16,500 square feet.

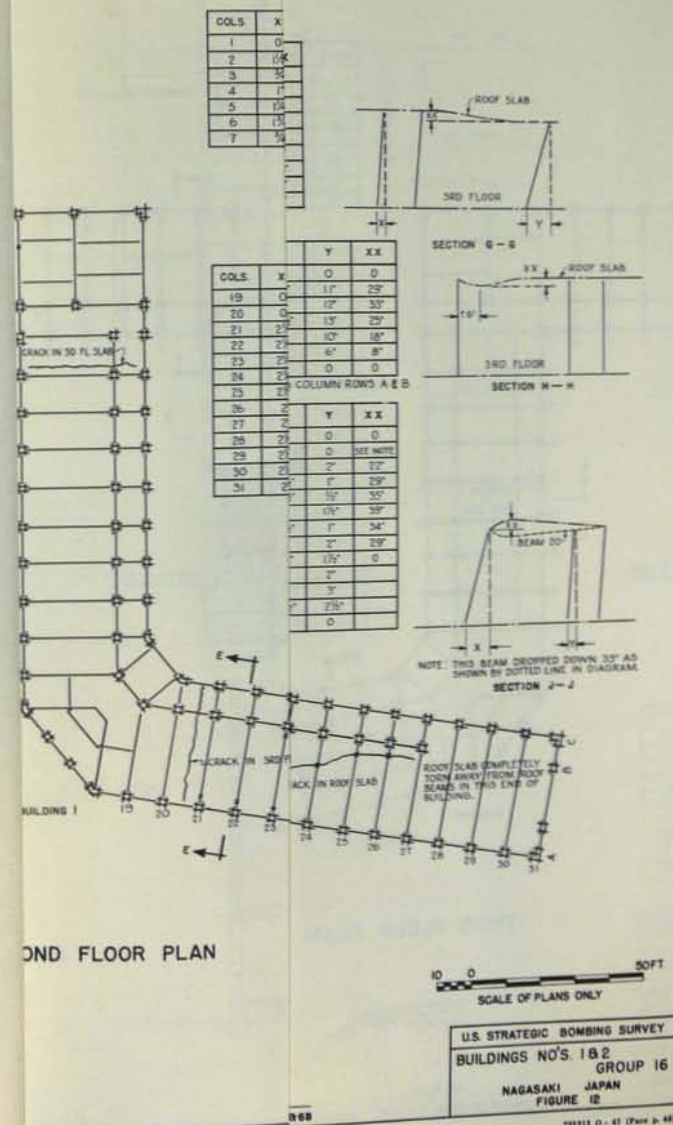
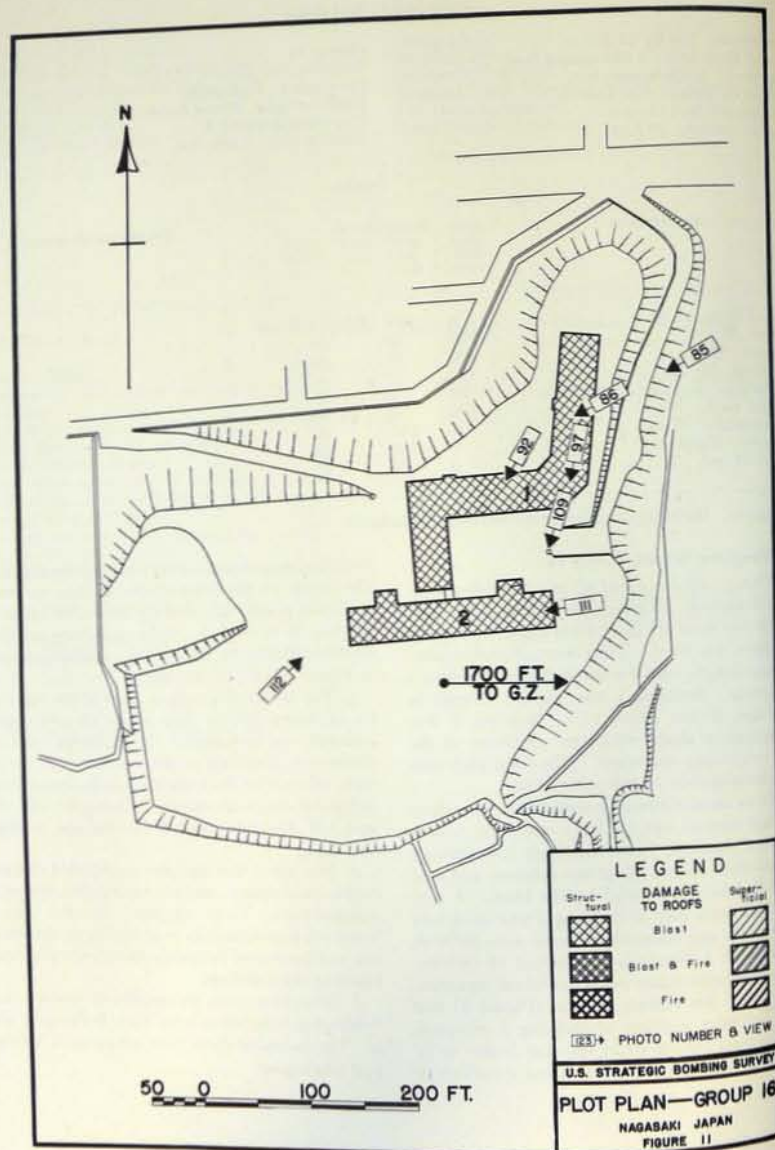
b. From aerial views or a casual inspection these buildings seemed not to have sustained serious structural damage; but a thorough investigation revealed that almost all of the columns and roof beams had been fractured by the blast. A portion of the east end of Building 2 was weakened by the blast and collapsed at some time between the dates of 3 September 1945 and 14 October 1945. No explanation could be found regarding the cause of this further collapse (Photos 84 and 85). The west stairway of Building 2 collapsed, and the blast caused all of the roof beams to be fractured. Many of the structural members in

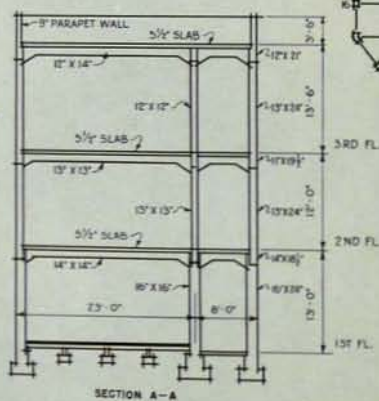
both Buildings 1 and 2 were fractured by the blast. The extent of the deformations of these members is shown graphically and by means of tables in Figures 12, 13, and 14. Column failures are illustrated in Photos 86, 92, and 101, and beam failures in Photos 89, 93, 97, and 99.

c. Fire occurred in various parts of the buildings on all floors, and in these areas all combustible material was consumed. The buildings were not exposed by dwellings or other structures. In the areas affected by fire nothing could be found which suggested secondary causes. Photos 93, 102, 105, and 106 illustrate typical fire damage in these buildings.

d. Fire protection equipment consisted of static tanks, hand pumps, and several 2-gallon soda-acid extinguishers. Trees uprooted by the atomic bomb fell across the only road leading to the school site and prevented the public fire department from reaching the buildings.

e. Tests were made on samples of concrete and reinforcing rods taken from both Buildings 1 and 2. The results of these tests are given in Volume 1 of this report.



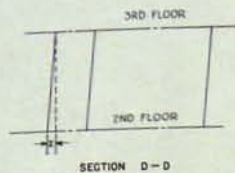


FIRST FLOOR PLAN

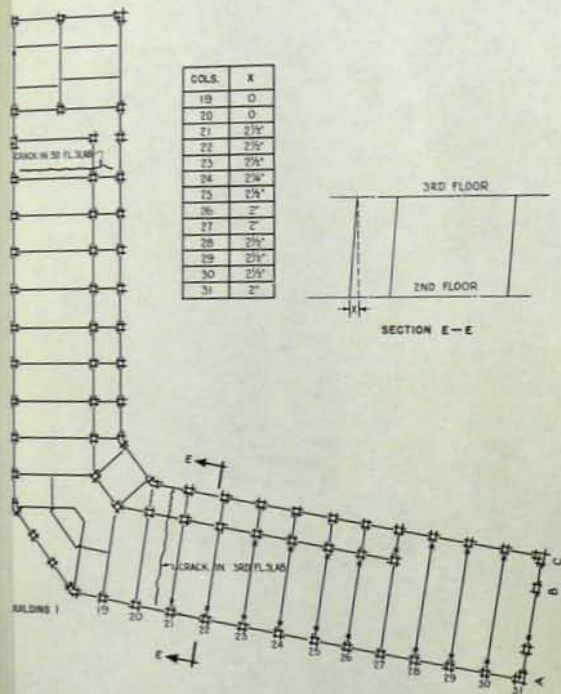
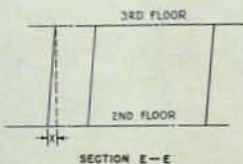


SECOND FLOOR PLAN

COLS.	X
1	0
2	1/4"
3	3/8"
4	1"
5	1 1/4"
6	1 3/4"
7	2"



COLS.	X
19	0
20	0
21	2 1/2"
22	2 1/2"
23	2 1/4"
24	2 1/4"
25	2 1/2"
26	2"
27	2"
28	2 1/2"
29	2 1/2"
30	2 1/2"
31	2"



2ND FLOOR PLAN

COLS.	Y
1	0
2	2 1/4"
3	2 1/4"
4	2"
5	1 1/2"
6	1 1/2"
7	1 1/2"
8	1 1/2"
9	1 1/2"
10	1 1/2"



COLS.	A	B
1	1' N	
2	0	
3	1/2' N	
4	1/2' S	1' N
5	1/2' S	1' N
6	1/2' S	1 1/2' N
7	1 1/2' S	3/4' S
8	1 1/2' S	1 1/2' N
9	1' S	0
10	2' S	1 1/2' N



THIRD FLOOR PLAN

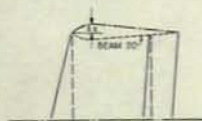
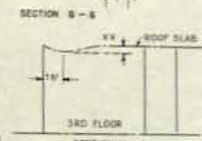
COLS.	XX
7	0
8	0
9	0
10	4
11	5
12	9
13	13
14	17
15	21



COLS.	X	Y	XX
1	0	0	0
2	1/2"	1"	2 1/2"
3	1"	1"	3"
4	1 1/2"	1"	3 1/2"
5	2"	1"	4"
6	2 1/2"	1"	4 1/2"
7	3"	1"	5"

FIGURES TAKEN ALONG COLUMN ROWS A & B

COLS.	X	Y	XX
19	0	0	0
20	1 1/2"	0	2 1/4"
21	1 1/2"	1"	2 1/4"
22	1 1/2"	1"	2 1/4"
23	1 1/2"	1"	2 1/4"
24	1 1/2"	1"	2 1/4"
25	1 1/2"	1"	2 1/4"
26	1 1/2"	1"	2 1/4"
27	1 1/2"	1"	2 1/4"
28	1 1/2"	1"	2 1/4"
29	1 1/2"	1"	2 1/4"
30	1 1/2"	1"	2 1/4"
31	0	0	0



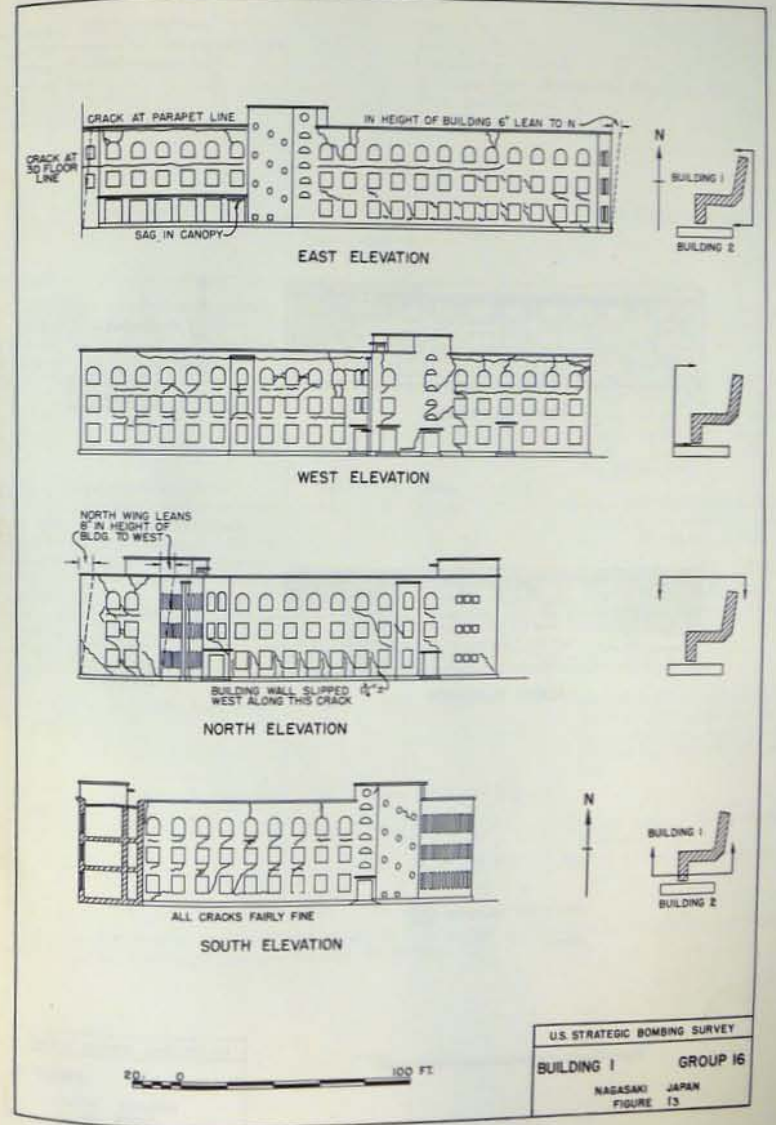
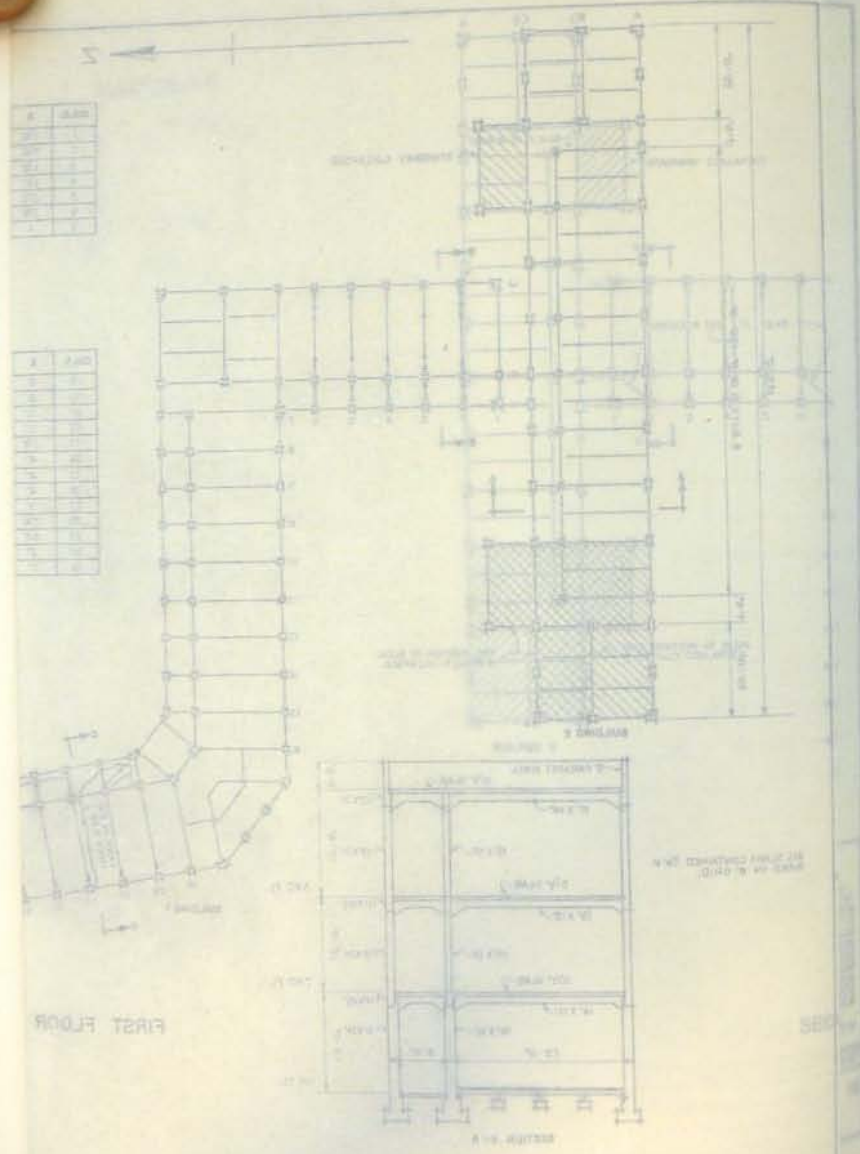
NOTE: THIS BEAM DROPPED DOWN 33" AS SHOWN BY DOTTED LINE IN DIAGRAM.

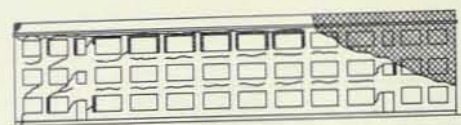
SCALE OF PLANS ONLY

U.S. STRATEGIC BOMBING SURVEY
BUILDINGS NO'S. 182
GROUP 16
NAGASAKI JAPAN
FIGURE 12

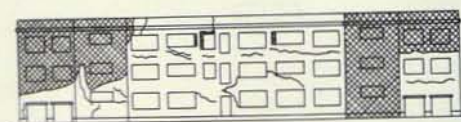
10000 G-47 (Rev. 9-48)

FAILURE OF COLS. AT HAUNCH-COLS. 2, 3, 4, 5, 6, 7

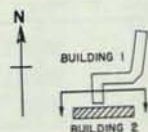
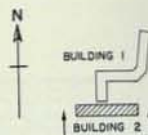






SOUTH ELEVATION



NORTH ELEVATION



COMPLETELY COLLAPSED 
CRACKS 

0 100 FT.

U.S. STRATEGIC BOMBING SURVEY
BUILDING 2 GROUP 16
NAGASAKI JAPAN
FIGURE 14

DAMAGE ANALYSIS

Dimensions: 208 by 150 feet.
Ground floor area: 10,730 square feet.
Total area: 32,200 square feet.
Number of floors: 3.
Eave height: 39 feet.
Mean elevation: 80 feet.

Group 16.
Building No. 1.
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 1,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: 5½-inch reinforced concrete slab on 12- by 21½-inch reinforced-concrete beams and 12- by 24-inch reinforced-concrete girders.	85	0	Blast	East wing failed upward. West wing failed downward. Photos 87, 88, 89, 93, 97, 103, and 106. Columns in east and west wings failed by bending to west. Wall columns in main wing failed by shear to west. Photos 86, 92, 93, 97, 98 and 101.
Trusses: None				
Columns: Reinforced concrete	60	0	Blast	Beams and slabs failed due to shear in an east-west direction. Photos 91, 95, 96, 99, and 106. Same type of failure as third floor. Some slabs failed by separating from beams. Photos 94 and 100.
Third floor: 5½-inch reinforced-concrete slab on 12- by 21½-inch reinforced-concrete beams and 12- by 24-inch reinforced-concrete girders.	35	0	do	
Second floor: 5½-inch reinforced-concrete slab on 12- by 21½-inch reinforced-concrete beams and 12- by 24-inch reinforced-concrete girders.	65	0	do	Diagonal cracks in center wing. Horizontal cracks at floor lines, east and west wings. Photos 85, 86, 92, 97, and 107.
First floor: Wood	60	0	Blast and fire	
Foundation: Reinforced-concrete piers.	10	0	Blast	All glass gone. Many frames distorted. See all photos of interior of building.
Exterior walls: 12-inch reinforced concrete.	60	0	do	
Interior walls: Reinforced concrete and wood.	0	50	Blast and fire	
Windows: Steel sash	0	100	Blast	
Finish: Wood and plaster	0	100	Blast and fire	

Remarks: Building so distorted and damaged that it may be classified as completely destroyed. Figures 12 and 13; Photos 84 through 101 and 103 through 107.

DAMAGE ANALYSIS

Dimensions: 185 by 31 feet.
Ground floor area: 5,750 square feet.
Total area: 17,250 square feet.
Number of floors: 3.
Eave height: 39 feet.
Mean elevation: 80 feet.

Group 16.
Building No. 2.
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 1,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: 5½-inch reinforced concrete slab on 12- by 14-inch reinforced concrete beams and 12- by 21-inch reinforced concrete girders.	100	0	Blast	Roof forced down into building. East end completely demolished. Photos 85, 100 and 111.
Columns: Wall columns, 13- to 16- by 24-inch. Interior columns, 12- by 12-inch to 16- by 16-inch.	85	0	do	
Third floor: 5½-inch reinforced concrete slab on 13- by 13-inch reinforced concrete beams and 11- by 19½-inch reinforced concrete girders.	85	0	do	Lengthwise crack in beams and slab. Photo 102.
Second floor: 5½-inch reinforced concrete slab on 14- by 14-inch reinforced concrete beams and 14- by 18½-inch reinforced concrete girders.	50	0	do	
First floor: Wood flooring on concrete slab.	0	100	Fire	
Foundation: Reinforced concrete.	10	0	Blast	
Exterior walls: 12-inch reinforced concrete with brick panels.	50	50	do	Cracks at spandrels and columns.
Windows: Steel sash.	0	100	do	All glass gone. Many frames distorted.
Finish: Wood and plaster.	0	100	Blast and fire	All interior finish gone.
Contents: School furniture.	0	100	Fire	

Remarks: Building so distorted and damaged that it may be classified as completely destroyed. Figures 12 and 14; Photos 84, 85, 102, and 108 through 113.

13. Nagasaki Medical College, Group 17

a. This group of buildings housed the Nagasaki Medical College. It was situated between 1,200 and 2,000 feet east of GZ as shown in Figure 15, and consisted of 76 buildings having a total plan area of 143,467 square feet. The buildings housed classrooms, laboratories, shops, and dormitories. Two of the buildings were special fire-resistive structures for record storage. Most of the buildings in the group were 100 percent damaged, usually by blast and fire, and only a very few escaped severe damage of some sort.

b. The majority of the buildings, 65 in all, were of wood construction. These were, without exception, destroyed by blast and fire. Although many of the buildings were in close proximity to each other, 20 to 50 feet, there were others which were sufficiently segregated to make the possibility of normal progressive conflagration improbable. Nevertheless the completeness of the destruction of all combustible material in the wood structures was consistent throughout the entire group.

c. The only load-bearing-wall structure in the group was Building 16. It had brick walls and

roof of tile-covered wood boards, supported by wood trusses. It was completely demolished by blast, and the wood roof and trusses were consumed by fire.

d. The nine reinforced-concrete buildings and the one reinforced-concrete-and-wood building revealed some interesting examples of fire and blast damage. Building 36, the mixed concrete-and-wood structure, was a one-story building with heavy concrete walls and ceiling beams, evidently built in expectation of the addition of a second story. The roof, constructed of timber trusses covered with wood and tile, was blown down by the blast and then completely consumed by fire. The gable end walls of reinforced concrete were broken at the eave line by the blast (Photo 117).

e. Building 12, alone among the reinforced-concrete buildings, was structurally damaged by blast only. Window frames and trim were damaged by blast and fire, but the serious damage was caused by blast which deflected the upper half of the west wall as shown in Photo 118. The column in this side as well as the wall and roof slabs were deflected.

f. Three panels of the west wall of Building 35A, another reinforced-concrete structure, were destroyed by blast, but the columns were not affected so the damage could not be classed as structural.

g. Two other reinforced-concrete structures, Buildings 50 and 51, were slightly damaged by blast, but this damage was restricted to collapse of the parapets on the east and west walls. The parapet failed along the flashing line.

h. An unusual fire incident was noted in Building 61, a special building designed as a record storage vault. This was a two-story reinforced-concrete structure. The windows were small and had steel casement sashes, protected with swinging-type iron shutters on the inside. One stair, not enclosed, at the northeast corner, led to the second floor. The wood floors were laid on sleepers which rested on concrete. The entrance on the north side was protected by a solid metal door which was closed at the time of the attack. Also on the north side was a small wood-covered entrance which was completely destroyed by blast and fire. Most of the window shutters were closed and latched at the time of the bomb's detonation, and all of them were blown off by blast. On the second floor, at the northwest side, the latch of the shutter was probably loose, and this shutter was not blown off by blast. It was interesting to note that the heavy flash burns on

this shutter clearly formed the outline of the steel window frames. Fire completely destroyed all combustible material on the first floor, although it was evident that blast also contributed to the total damage. The contents consisted of books and reference material, some of it in heavy volumes, stored on steel racks and shelving. The racks were distorted by heat. There was similar storage on the second floor, although the racks covered only the eastern half thereof. No fire occurred on this floor, and there was little evidence of damage from blast other than distorted window sashes and shutters blown off and crumpled.

i. Building 60A also presented unusual fire features. Its construction was similar to that of Building 61. Interior steel shutters were provided, some of which were blown off their hinges. All of these were so badly rusted that no flash burns could be noted. A considerable amount of the exterior cement finish had, however, been burned to a pinkish cast on the exposed sides, in contrast to the normal buff color. Wired glass (three-sixteenths inch thick and of good quality) was set in steel frames on the east side. The reason for this was not apparent unless it was a precaution against landslides. It was noted that this glass was not completely broken out, as was the glass in all the other fire-resistive buildings, but was partly melted. This building was used exclusively as a record vault. Steel racks or shelving contained reference material and books, many of which were undoubtedly 1 to 3 inches in thickness and had hard-back covers. Internal fire completely consumed all combustible contents on both floors and badly damaged the stair leading from the first to the second floor. Damage to the building included disintegration of finish plaster, flooring, wood trim, and stair treads.

j. This structure was exposed on the south by a two-story wood structure adjoining, which burned completely after the blast. There was one opening in the masonry wall on the first floor, which was protected by a closed rolling steel shutter and an inner door of light steel-paneled construction. Blast split the shutter about 2 feet above the door sill and somewhat distorted the steel door inside. It was judged that fire would not spread through this small opening to cause such complete combustion within the vault building. About 12 feet distant from the west side of Building 60A was a small wood structure used as a lavatory. This was totally destroyed by blast and fire. Between this building and Building 60A stood a large tree

which was badly distorted by blast, and had flash burns on the bark, but the tree was not burned nor scorched as might have been expected because of its proximity to a burning wood building. This indicated that Building 60A was not exposed to any excessive heat by the burning of the small structure.

k. All of this evidence seems to indicate that the internal fire in Building 60A was due to primary causes. The same may be said of the fire in Building 61. Fire destroyed the contents of the other masonry buildings, although electrical

and chemical equipment sustained blast damage only. An exception to this was the chemistry building, Building 50, where fire damaged only the stair leading to the roof.

l. Fire protection equipment for the group consisted of static tanks, hand pumps, and fire extinguishers. Under normal conditions the public fire department would have had access to the college buildings.

m. The following table lists the extent of fire and blast damage to buildings and fire damage to contents.

Building No.	Occupancy	Fire class	Estimated damage, blast and fire, buildings		Fire, contents
			Superficial	Structural	
(1)	School and dormitories	C	Total	Total	Total
12	Stockroom	R	do.	Moderate	do.
13A	Storehouse	R	Slight	None	do.
14	Furnace room	R	do.	do.	do.
16	Laboratory	(1)	Total	Total	do.
29	Switch gear room	R	Slight	None	do.
35A	Warehouse	R	Moderate	Slight	do.
36	Study hall	(1)	Severe	Moderate	do.
50	Laboratory	R	Slight	Slight	None
51	do.	R	do.	do.	Total
60A	Record vault	R	do.	None	Do.
61	do.	R	do.	None	Serious

¹ Building classification, Group 17 chart, shows building numbers of schools and dormitories.

² Roof C, balance N.

³ Roof C, balance R.

Additional information on construction details and damage in this group will be found in Photos

114 through 126 and in the damage analysis sheets immediately following Figure 15.

Building classification, Group 17

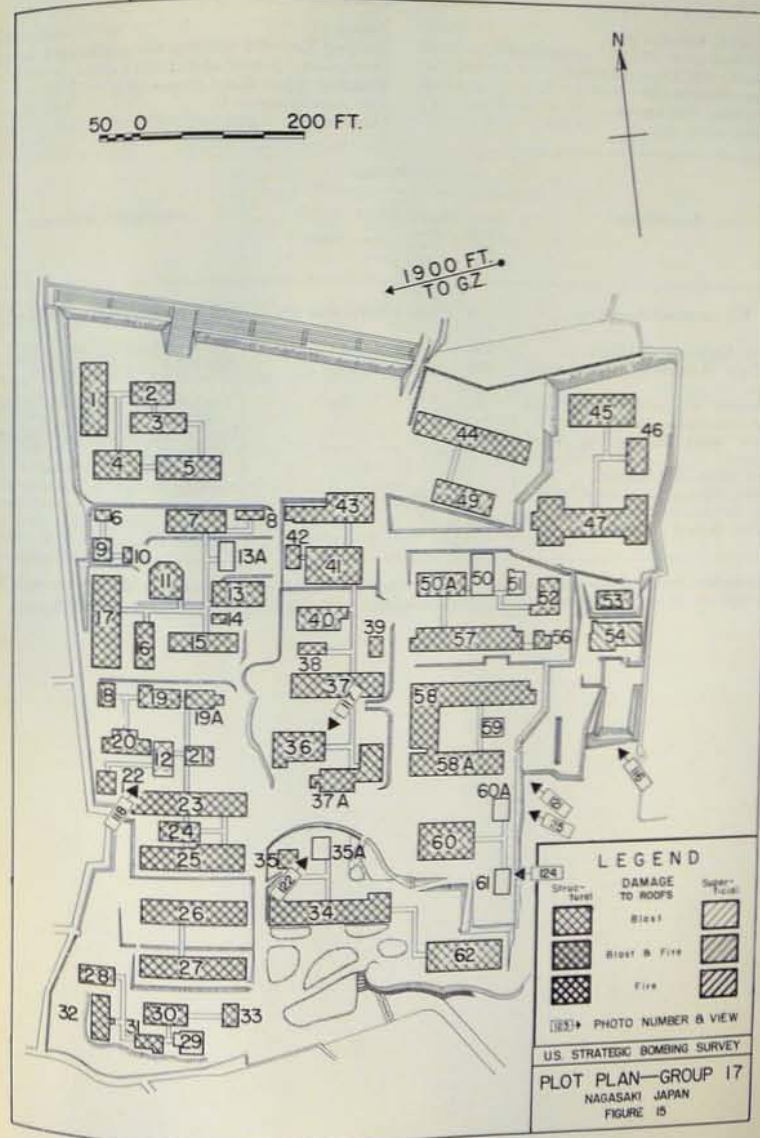
Building No.	Area		Type	Fire class	Construction		
	Plan	Total floor			Reinforced concrete	Load-bearing wall	Wood
1 through 11; 13; 15; 17 through 28; 30 through 35; 37 through 49; 52 through 60; 62	132,521	132,521	D	C			X
12	1,222	2,444	E2	R	X		
13A	700	1,400	E1	R	X		
14	198	198	S	R	X		
16	1,140	1,140	D	C & N		X	
29	840	840	D	R	X		
35A	750	1,500	E1	R	X		
36	2,630	2,630	D	C & R	X		
50	1,650	1,650	D	R	X		
51	616	1,232	E2	R	X		
60A	600	1,200	E2	R	X		
61	600	1,200	E2	R	X		
Total	143,467	147,955			10	1	

¹ 65 buildings.

² Roof.

³ 1 wood roof.

⁴ 2 wood roofs.



DAMAGE ANALYSIS

Dimensions: See plot plan.
Ground floor area: 132,521 square feet.
Total area: 132,521 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 65.

Group 17.
Building No.: See remarks for numbers.
Occupancy: School and study halls.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,200 to 2,000 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	All wooden roofs consumed by fire.
Trusses: Light wood rafters	100	0	do	All roof framing destroyed.
First floor: Wooden flooring on wood joists	100	0	do	No floor or joists remain.
Foundation: Concrete, brick, and stone foundation walls	20	0	do	Found walls are all that remain of these 65 buildings.
Exterior walls: Stucco on wood frames	100	0		Only particles of concrete stucco remain.
Interior walls: Not known.	0	100		
Windows: Plain glass in wood frames	0	100		
Finish: Not known	0	100		
Contents: School equipment	0	0		

Remarks: Buildings included on this sheet: 1 through 11; 13; 15; 17 through 28; 30 through 37 through 49; 52 through 60; and 62, total 65 buildings. Photos 114, 115, 116, 121, and 124.

DAMAGE ANALYSIS

Dimensions: 26 by 47 feet.
Ground floor area: 1,222 square feet.
Total area: 2,444 square feet.
Number of floors: 2.
Eave height: 32 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 12.
Occupancy: Stockroom.
Building type: Reinforced concrete (E2).
Fire classification: R.
Ground zero: 1,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: 6-inch reinforced concrete slab.	0	80	Blast	Photo 118.
Columns: 16- by 18-inch reinforced concrete, exterior; 16- by 16-inch reinforced concrete, interior.	20	0		
Second floor: 6-inch reinforced concrete slab.	0	0		
First floor: Concrete on earth.	0	0		
Foundation: Reinforced concrete.	0	0		
Exterior walls: 8-inch reinforced concrete between columns.	40	0	Blast	
Interior walls: 8-inch reinforced concrete between columns.	0	0		
Windows: Plain glass, wood frames.	0	100	Blast and fire	
Finish: Wood trim and plaster.	0	100	do	
Contents: Small stocks.	0	0		

Remarks: Building structurally damaged by blast. Photo 118.

DAMAGE ANALYSIS

Dimensions: 20 by 35 feet.
Ground floor area: 700 square feet.
Total area: 1,400 square feet.
Number of floors: 2.
Eave height: 32 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 13A.
Occupancy: Storeroom.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 1,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: 13- by 18-inch reinforced concrete.	0	0		
Second floor: Reinforced-concrete slab.	0	0		
First floor: Reinforced-concrete slab.	0	0		
Basement: Reinforced-concrete walls, concrete floor.	0	0		
Foundation: Reinforced-concrete walls.	0	0		
Exterior walls: 6-inch reinforced concrete between columns.	0	0		
Interior walls: Lath and plaster	0	100	Blast and fire	
Windows: Plain glass, wood sash	0	100	do	
Finish: Wood and plaster	0	100	do	
Contents: Not known.				

Remarks: No structural damage. Low parapet walls not damaged. Interior walls and trim destroyed by fire.

DAMAGE ANALYSIS

Dimensions: 11 by 18 feet.
Ground floor area: 198 square feet.
Total area: 198 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 14.
Occupancy: Furnace room.
Building type: Reinforced concrete (S).
Fire classification: R.
Ground zero: 1,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
First floor: Concrete on earth	0	0		
Foundation: Reinforced-concrete walls.	0	0		
Exterior walls: 8-inch reinforced-concrete walls.	0	0		
Windows: Wire glass, metal frames	0	100	Blast and fire	
Finish: Wood and plaster	0	100	do	
Contents: Furnace	0	0		

Remarks: No structural damage. Low parapet wall not damaged. Interior trim destroyed by fire.

DAMAGE ANALYSIS

Dimensions: 20 by 37 feet.
Ground floor area: 1,140 square feet.
Total area: 1,140 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 65 feet.

Group 17.
Building No. 16.
Occupancy: Laboratory.
Building type: Brick and wood (D).
Fire classification: C and N.
Ground zero: 1,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	Wooden roof completely destroyed by fire.
Trusses: Heavy wood	100	0		
First floor: Wood floor on wood joist	100	0	Blast and fire	
Foundation: Brick walls	90	0	do	
Exterior walls: 13-inch brick	100	0	do	
Interior walls: Not known	0	0		
Windows: Plain glass, wood frames	0	100	Blast and fire	
Finish: Not known	0	100	do	
Contents: Small instruments	0	0		

Remarks: Walls collapsed by blast. Roof and trim destroyed by fire.

DAMAGE ANALYSIS

Dimensions: 28 by 30 feet.
Ground floor area: 840 square feet.
Total area: 840 square feet.
Number of floors: 1.
Eave height: 20 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 29.
Occupancy: Switch gear room.
Building type: Reinforced concrete (D).
Fire classification: R.
Ground zero: 1,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Reinforced concrete	0	0		
Windows: Plain glass, metal frames	0	100	Blast and fire	
Contents: Switch gear	25	0	do	

Remarks: No structural damage in this building. Superficial damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: 25 by 30 feet.
Ground floor area: 750 square feet.
Total area: 1,500 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 35A.
Occupancy: Warehouse.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 1,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: 6-inch reinforced-concrete slab.	0	0		
Columns: 16- by 16-inch reinforced concrete.	0	0		
Second floor: 6-inch reinforced-concrete slab.	0	0		
First floor: Concrete on earth.	0	0		
Foundation: Concrete walls.	0	0		
Exterior walls: 6-inch reinforced concrete between columns.	25	0	Blast	3 panels of west wall destroyed. Photos 122 and 123.
Windows: Plain glass, wood frames.	0	100	Blast and fire	
Finish: Wood trim and plaster.	0	100	do	
Contents: Not known	0	0		

Remarks: No columns damaged. Walls between columns collapsed inward on west side of the building. Photos 122 and 123.

DAMAGE ANALYSIS

Dimensions: 45 by 75 feet over-all.
Ground floor area: 2,630 square feet.
Total area: 2,630 square feet.
Number of floors: 1.
Eave height: 18 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 36.
Occupancy: Study hall.
Building type: Reinforced concrete (D).
Fire classification: R (walls), C (roofs).
Ground zero: 1,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Heavy wood	100	0	do	
First floor: Concrete on earth	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: 8-inch reinforced-concrete walls and gable walls.	25	0	Blast	Photo 117.
Interior walls: Lath and plaster	0	100	Blast and fire	
Windows: Plain glass, wood frames	0	100	do	
Finish: Wood trim and plaster	0	100	do	
Contents: Not known	0	0		

Remarks: East and west gable walls broken off at roof line by blast. Roof and interior walls destroyed by blast and fire. Photo 117.

DAMAGE ANALYSIS

Dimensions: 30 by 55 feet.
Ground floor area: 1,650 square feet.
Total area: 1,650 square feet.
Number of floors: 1.
Eave height: 15 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 50.
Occupancy: Laboratory.
Building type: Reinforced concrete (D).
Fire classification: R.
Ground zero: 1,600 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Reinforced-concrete walls and 6-inch parapet walls above roof	10	0	Blast	East parapet wall broken off at roof line. Photo 126.
Interior walls: Wood lath and plaster	0	100	do	
Windows: Plain glass	0	100	do	
Finish: Wood trim, plaster	0	0		
Contents: Laboratory equipment	0	0		

Remarks: Small fire damage at stairway to roof. Photo 126.

DAMAGE ANALYSIS

Dimensions: 22 by 28 feet.
Ground floor area: 616 square feet.
Total area: 1,232 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 51.
Occupancy: Laboratory.
Building type: Reinforced concrete (E2).
Fire classification: R.
Ground zero: 1,600 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Basement: Concrete walls and floor	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Reinforced concrete with 6-inch parapet above roof	10	0	Blast	Parapet walls on east and west sides collapsed at roof line. Photo 125.
Interior walls: Reinforced concrete	0	0		
Windows: Plain glass, wood frame	0	100	Blast and fire	
Finish: Wood trim and plaster	0	100	do	
Contents: Laboratory equipment	0	0		

Remarks: Only structural damage to parapet walls. Photo 125.

DAMAGE ANALYSIS

Dimensions: 20 by 30 feet.
Ground floor area: 600 square feet.
Total area: 1,200 square feet.
Number of floors: 2.
Eave height: 28 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 60A.
Occupancy: Record vault.
Building type: Reinforced concrete (E2).
Fire classification: R.
Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Reinforced concrete	0	0		
Windows: Wire glass, metal frames	0	100	Blast and fire	
Finish: Wood trim and plaster	0	100	do	
Contents: Paper records	0	0		

Remarks: No structural damage to this building. Wood trim and contents destroyed by fire.

DAMAGE ANALYSIS

Dimensions: 20 by 30 feet.
Ground floor area: 600 square feet.
Total area: 1,200 square feet.
Number of floors: 2.
Eave height: 28 feet.
Mean elevation: 65 feet.

Group 17.
Building No. 61.
Occupancy: Record vault.
Building type: Reinforced concrete (E2).
Fire classification: R.
Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Reinforced concrete	0	0		
Windows: Wire glass, metal frames	0	100	Blast and fire	
Finish: Wood trim and plaster	0	100	do	
Contents: Paper records	0	0		

Remarks: No structural damage to this building. Wood trim and contents destroyed by fire. Photo 120.

14. Chinzei School, Group 18

a. There were two buildings in the group. Building 2, a wood-frame structure, was completely demolished by blast. At the time of the survey almost all of the remaining wreckage had been carried away for the construction of temporary homes. Some of the remaining debris is shown in Photo 140. It occupied a ground area of approximately 7,000 square feet, approximately 1,700 feet southwest of GZ. Building 1 was a reinforced-concrete, four-story structure with a steel-truss, concrete-slab roof over the northerly one third, and a wood-truss, tile-covered roof over the southerly two thirds. The building was situated on a hill, 1,500 feet from GZ, and the north end, east side, and roof were directly exposed to the blast of the atomic bomb. Figure 17 shows the construction of this building and the damage thereto.

b. Eighty-three feet of the east wall at the north end of Building 1 above the third-floor line collapsed and fell on the third floor. The steel trusses remained fastened to the top of the wall on the opposite side, and, although the wall leaned, it did not completely fall. A basement existed in the central portion of the building between column rows 6 and 11. The only floor-slab failure oc-

curred in this area where part of the first-floor slab collapsed and fell into the basement probably because the enclosed basement caused an unequal pressure to be expected on the top and bottom surfaces of the slab. This condition did not exist in floor slabs above the ground level.

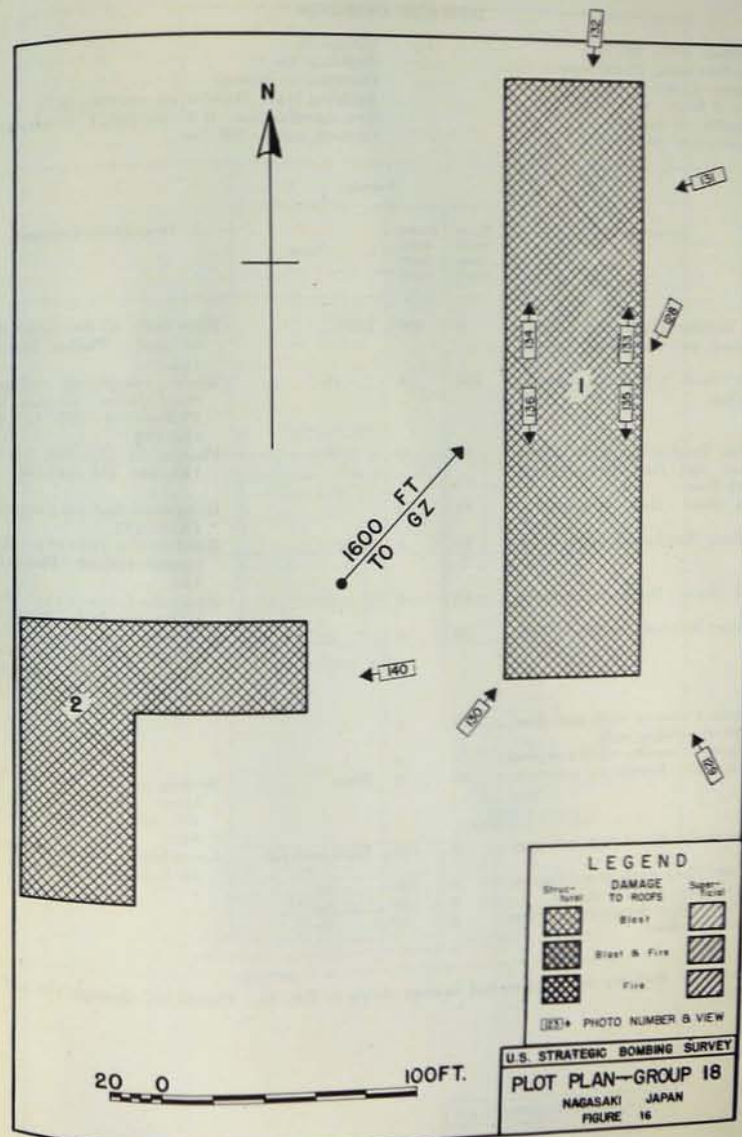
c. The downward pressure of the blast in this area was illustrated by the sinking of a concrete step and landing at the east entrance to Building 1. This concrete slab broke away from the main structure and was lowered approximately 7 inches (Photo 128).

d. Fire consumed all combustible material on the first, second, and part of the third floors in Building 1. No fire occurred on the fourth floor or in the wooden roof structure. Fire in this building may have originated in machines located on the first floor, although there is no evidence of open-flame devices. The buildings were not exposed by dwellings, and conflagration from exposure was improbable.

e. There was no evidence of fire in the debris of Building 2.

f. Fire protection equipment consisted of static tanks and hand pumps.

g. The results of tests made on concrete and reinforcing steel rod samples from Building 1 are shown in Volume 1 of this report.



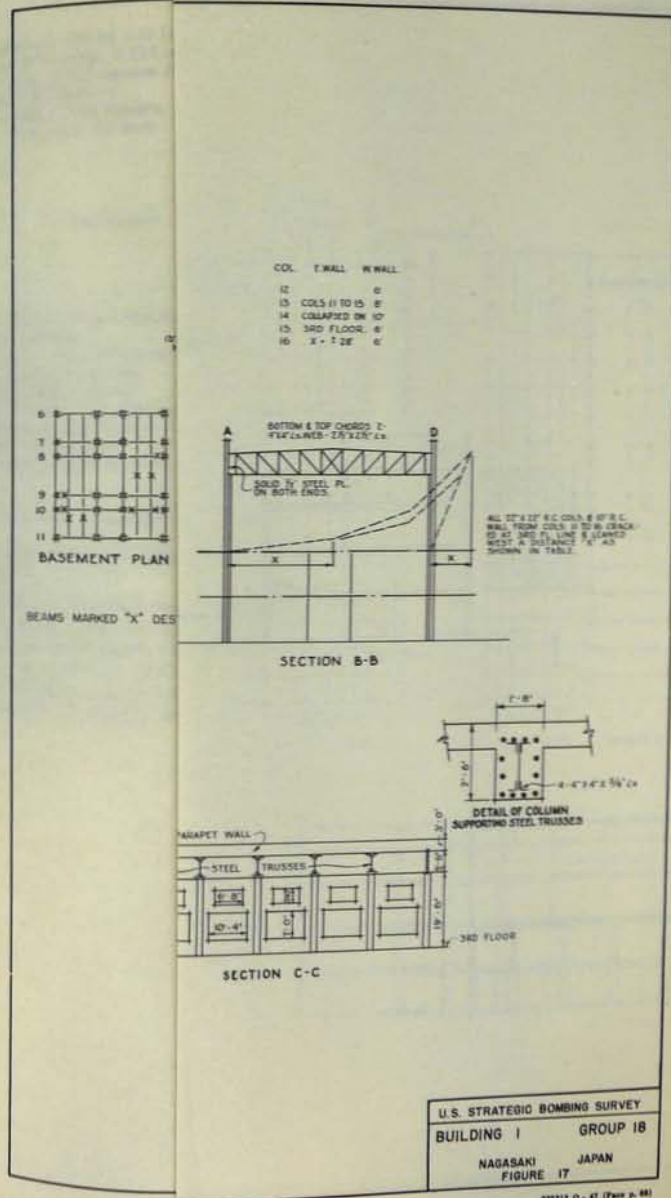
DAMAGE ANALYSIS

Dimensions: 55 by 228 feet.
Ground floor area: 12,540 square feet.
Total area: 45,600 square feet.
Number of floors: 4.
Eave height: 48 feet.
Mean elevation: 60 feet.

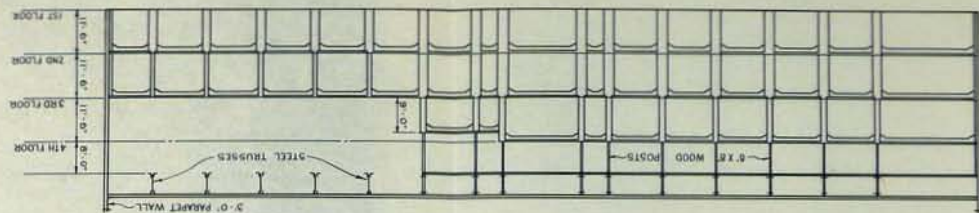
Group 18.
Building No. 1.
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: R 37 percent, C 63 percent.
Ground zero: 1,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab $\frac{1}{2}$ building, pile and wood $\frac{1}{2}$ building.	0	100	Blast	Blast only, no fire on 4th floor or roof. Photos 134 and 135.
Trusses: Steel $\frac{1}{2}$ building, wood $\frac{1}{2}$ building.	100	0	do	Wood completely collapsed. Steel fallen at east side. Photos 134, 135, 137, 138 and 139.
Columns: Reinforced concrete, first, second, and third floors; wood, fourth floor.	80	0	do	Photos 134, 135, 136, 142, 144, 145, 146, 155, and 156.
Fourth floor: Reinforced-concrete slab.	40	0	do	Reinforced floor beams cracked. Photo 152.
Third floor: Reinforced-concrete slab.	40	0	Blast	Reinforced-concrete floor beams cracked. Photos 140, 153.
Second floor: Reinforced-concrete slab.	40	0	do	Reinforced-concrete floor beams cracked. Photo 154.
First floor: Reinforced-concrete slab.	20	0	do	Reinforced-concrete floor beams cracked; reinforced concrete slab destroyed. Photos 141, 147, 150, and 151.
Basement: Concrete walls and floor, center of building only.	0	0	do	
Foundation: Concrete walls and piers.	0	0	do	
Exterior walls: Reinforced concrete.	25	0	Blast	Broken at 3d and 4th floor lines. Photos 127, 129, 131, 132, 133, 135, 136, and 148.
Interior walls: Wood lath and plaster.	0	100	Blast and fire	Completely destroyed by fire on 1, 2, and 3 floors.
Windows: Plain glass, wood frames.	0	100	do	
Finish: Wood trim and plaster.	0	100	do	
Contents: School furniture; machinery on first floor.	0	50	do	

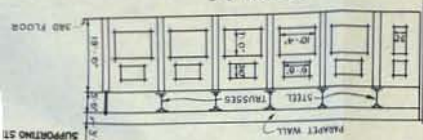
Remarks: Building construction and damage shown on Fig. 17. Photos 127 through 139 and through 156.



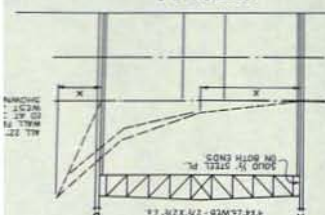
LONGITUDINAL SECTION



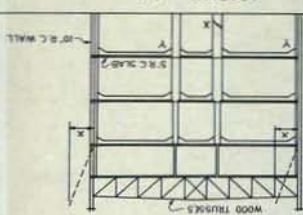
SECTION C-C



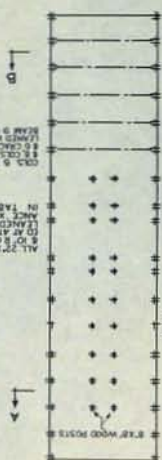
SECTION B-B



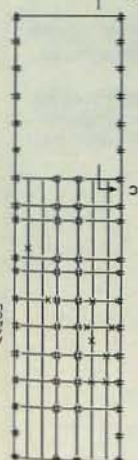
SECTION A-A



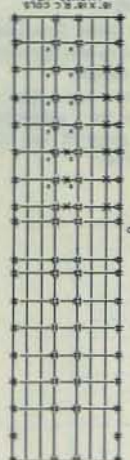
4TH FLOOR



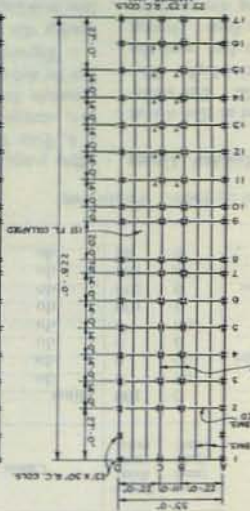
3RD FLOOR



2ND FLOOR



1ST FLOOR



MENT PLAN



BEAMS MARKED "X" DESTROYED

**WATERLOO
AND BLACK**

9.25.0

1.4.1.2

10

11

100

Dimensions:
Ground floor
Total area:
Number of floors:
Eave height:
Mean elevation:

Roof: Reinforced building
Trusses: Steel building

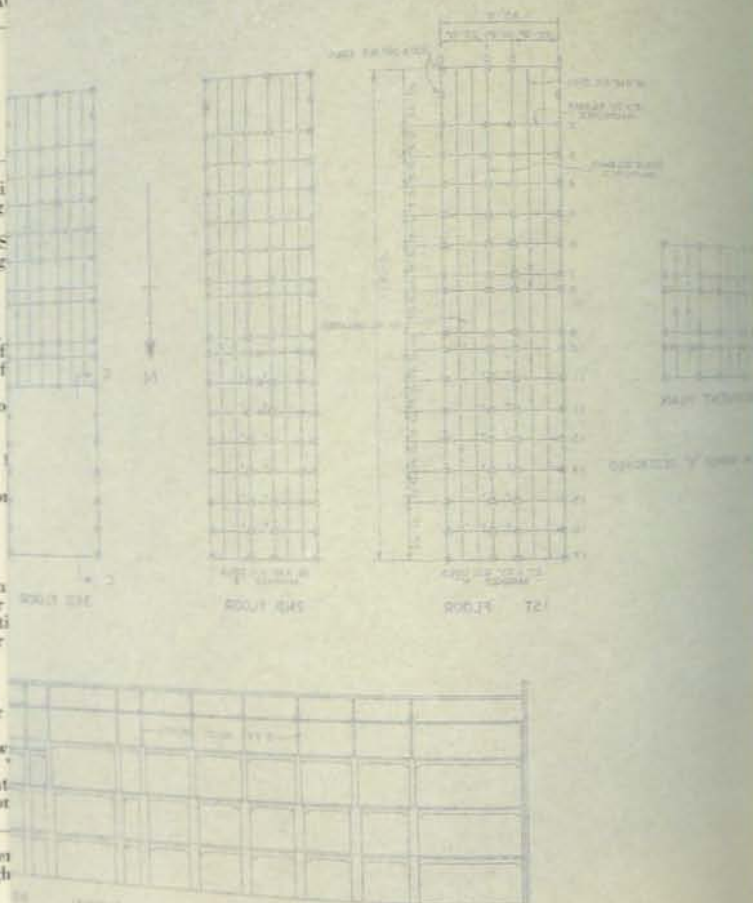
Columns: second, fourth floor
Fourth floor slab
Third floor

Second floor slab
First floor

Basement center
Foundation
Exterior

Interior
Window
Finish
Content
ery of

Reinforced through



DAMAGE ANALYSIS

Dimensions: 110 by 110 feet over all.
Ground floor area: 3,775 square feet.
Total area: 3,775 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 60 feet.

Group 18.
Building No. 2.
Occupancy: School.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 1,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast	
Trusses: Wood	100	0	do	
First floor: Wood floor on wood joist	100	0	do	
Foundation: Concrete	0	0	do	
Exterior walls: Wood	100	0	do	
Interior walls: Not known	0	100	do	
Windows: Clear glass, wood frames	0	100	do	
Finish: Not known	0	100	do	
Contents: School furniture	0	50	do	

Remarks: Building demolished by blast. Photo 140.

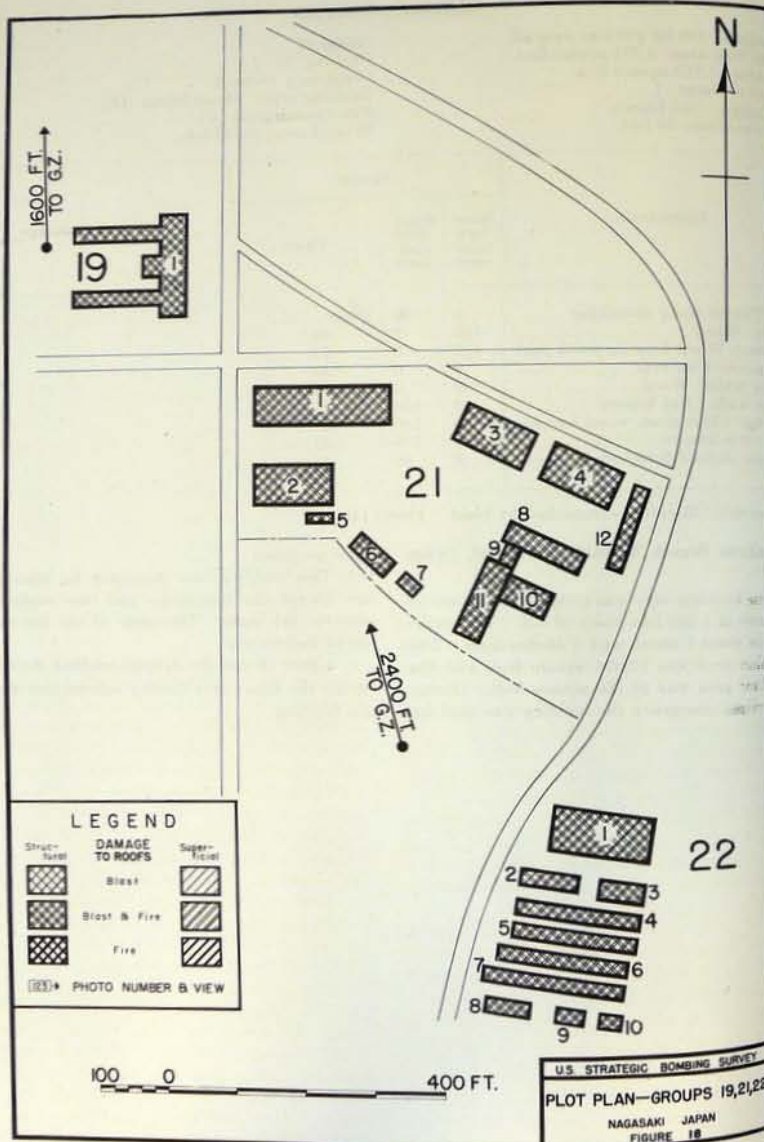
15. Urakami Branch Mitsubishi Hospital, Group 19

a. One building only was situated at this site at a distance of 1,600 feet south of GZ. The structure was wood framed, and 2 stories high. The total plan area was 12,075 square feet, and the total floor area was 24,150 square feet. During the wartime emergency the building was used for

office purposes.

b. This building was destroyed by blast and fire, except the foundation and two reinforced-concrete fire walls. The cause of the fire could not be determined.

c. Figure 18 and the damage-analysis sheet following the figure give further information about this building.



DAMAGE ANALYSIS

Dimensions: 150 by 170 feet (varies).
 Ground floor area: 12,075 square feet.
 Total area: 24,150 square feet.
 Number of floors: 2.
 Eave height: 24 feet.
 Mean elevation: 10 feet.

Group 19.
 Building No. 1.
 Occupancy: Offices.
 Building type: Wood frame (A2.1).
 Fire classification: C.
 Ground zero: 1,600 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Wood and tile	0	100	Blast and fire	Destroyed by blast and fire.
Trusses: Wood	100	0	do.	
Columns: Wood	100	0	do.	
Second floor: Wood	100	0	do.	
First floor: Wood	100	0	do.	2 fire walls still standing.
Foundation: 12 inches thick, 18 to 30 inches high.	0	0	do.	
Exterior walls: 2 reinforced-concrete fire walls; others wood, wire lath, and plaster.	100	0	Blast and fire	
Interior walls: Lath and plaster	0	100	do.	
Windows: Wood sash	0	100	do.	

16. Nagasaki University Hospital, Group 20

a. In this group there were 39 buildings of which 21 were of reinforced-concrete construction, 15 wood frame, 2 load-bearing brick-wall structures with combustible roofs, and 1 noncombustible steel-frame structure. They were located between 1,800 feet and 2,500 feet southeast of GZ and covered a total plan area of approximately 137,000 square feet. Every one of the buildings suffered some damage, 8 of them from blast only and 31 from a combination of fire and blast.

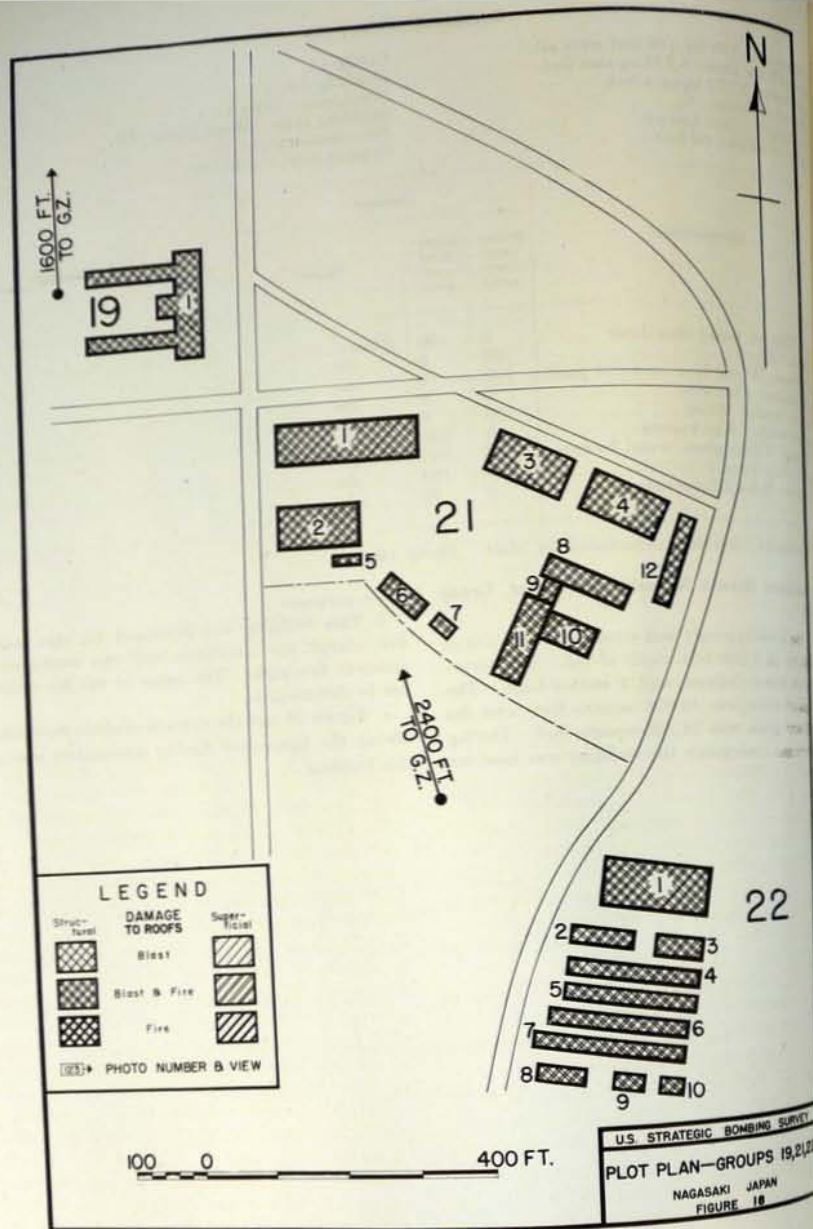
b. Building classification analysis sheet follows:

c. The single steel-frame structure, Building 23, suffered no structural damage, although the corrugated-asbestos roofing and siding were destroyed.

d. The reinforced-concrete buildings were of modern slab-and-beam construction with heavy beams and girders and thick floor and roof slabs. Although these structures were comparatively close to GZ, the only structural damage occurred to parapet walls which in some cases broke at the flashing joint just above the roof. Window frames and interior wood-frame walls were distorted away from the blast, and where fire had not destroyed the evidence it was found that the hung

ceilings were blown upward against the ceiling slab. Fire was the chief cause of destruction of interior trim, partitions, and contents of these buildings.

e. While it was possible that there were volatile materials in some of these buildings, ignition of these materials by radiant heat or by blast alone was not thought to be an adequate explanation for the occurrence of the fires. The completeness with which fire consumed all combustible material, including floor overlays, wood sleepers, ceilings suspended from 4-inch by 4-inch wood stringers, and interior door frames, in most of the large fire-resistant buildings did not suggest that the source of the ignition was from progressive conflagration, or secondary causes. The buildings which were completely burned out or damaged by serious internal fires were generally of fairly large area with numerous partitions of reinforced concrete or concrete block on all floors. It appeared that the fires started in many places almost simultaneously and burned intensely. Books were completely burned to fire ash, glass was fused into a shapeless mass, and all wood, including stair treads and heavy balustrade hand rails, was consumed. Metal beds were badly distorted, as were metal cabinets, file racks, chairs, carriers, and the



Dimensions: 150 by 170 feet (varies).
Ground floor area: 12,075 square feet.
Total area: 24,150 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 10 feet.

DAMAGE ANALYSIS

Group 19.
Building No. 1.
Occupancy: Offices.
Building type: Wood frame (A2.1).
Fire classification: C.
Ground zero: 1,600 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Wood and tile	0	100	Blast and fire	Destroyed by blast and fire.
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
Second floor: Wood	100	0	do	
First floor: Wood	100	0	do	
Foundation: 12 inches thick, 18 to 30 inches high	0	0		
Exterior walls: 2 reinforced-concrete fire walls; others wood, wire lath, and plaster	100	0	Blast and fire	2 fire walls still standing.
Interior walls: Lath and plaster	0	100	do	
Windows: Wood sash	0	100	do	

16. Nagasaki University Hospital, Group 20

a. In this group there were 39 buildings of which 21 were of reinforced-concrete construction, 15 wood frame, 2 load-bearing brick-wall structures with combustible roofs, and 1 noncombustible steel-frame structure. They were located between 1,800 feet and 2,500 feet southeast of GZ and covered a total plan area of approximately 137,000 square feet. Every one of the buildings suffered some damage, 8 of them from blast only and 31 from a combination of fire and blast.

b. Building classification analysis sheet follows:

c. The single steel-frame structure, Building 23, suffered no structural damage, although the corrugated-asbestos roofing and siding were destroyed.

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ceilings were blown upward against the ceiling slab. Fire was the chief cause of destruction of interior trim, partitions, and contents of these buildings.

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Building classification, Group 20

Building No.	Area		Type	Fire class	Construction			
	Plan	Ground			Steel	Reinforced concrete	Load-bearing wall	Wood
1.	275	275	D	R		X		
2.	480	480	D	R		X		
3.	625	625	D	R		X		X
4.	1,650	1,650	D	C		X		
5.	6,400	12,800	E2	R				X
6, 7, 8.	5,250	5,250	D	C				X
9.	1,300	1,300	D	C				
10.	1,600	1,600	D	R		X		
11.	3,000	6,000	E1	R		X		
12.	3,810	7,620	E2	R		X		X
13.	6,750	13,500	D	C		X		
14.	1,288	1,288	E1	R		X		
15.	7,200	14,400	E1	R		X		
16.	6,125	12,250	E1	R		X		
17.	3,344	5,168	E1	R		X		
18.	4,100	6,600	E1	R		X		
19.	4,600	9,200	E1	R		X		
20.	3,250	6,500	E1	R	X			
21.	4,200	4,200	D	N		X		
22.	2,400	4,800	E1	R		X		
23.	2,400	4,800	E1	R		X		
24.	1,200	2,400	E1	R		X		
25.	12,200	36,600	E1	R			² X	² X
26.	495	495	D	C & N		X		
27.	9,000	27,000	E1	R				X
28.	7,400	7,400	D	C				X
29.	1,800	1,800	D	C		X		
30.	9,000	27,000	E1	R				
31.								
32.								
32A.								
33.								¹ X
34.								
34A.	8,900	8,900	D	C				
35.								
36.								
36A.								
37.	10,600	31,800	E1	R		X		
38.	5,934	14,835	E1	R		X		
39.	2,000	2,000	D	R			² X	² X
40.	1,200	1,200	D	C & N				
Total.	137,406	276,996			1	21	² 2	¹ 17

¹ 3 buildings.

² Part.

³ 6 buildings.

⁴ 2 part.

like. Paint on exterior doors and window frames was badly blistered. There was evidence of a high degree of heat in many places along exposed sides of stucco-covered exterior walls which changed a normal buff color to pink. In a few of the fire-resistive buildings there was evidence of less severe fire in segregated rooms on various floor levels. These fires behaved in a normal manner considering the type of building involved, and

burned out without consuming all of the building contents.

f. In no case was a fire-resistive building structurally damaged by fire. A few days before the atomic-bomb attack three of these reinforced-concrete structures, Buildings 17, 18, and 33, were structurally damaged by high-explosive bombs. In the sections of the buildings damaged by these bombs no evidence could be found of additional

structural damage by the atomic bomb other than the broken parapet walls already noted.

g. The two load-bearing-wall buildings were both severely damaged by blast, and fire consumed all the combustible parts of their roofs.

h. Fourteen of the 15 wood-frame buildings were completely destroyed by blast and fire, and the fifteenth, Building 4, was completely demolished by blast. All combustible material was consumed in those buildings which were damaged by fire; nothing remained except powder or ashes. Even where heavy roof tiles fell on wood, the wood beneath was consumed. These buildings were, for the most part, protected by reinforced-concrete structures on each side, which discounted the possibility of a general conflagration spreading from one combustible structure to another.

i. The group was located on a sharp rise of land, sufficiently segregated from residential areas below to preclude the possibility of conflagration therefrom. The fire-resistive buildings were, in general, well segregated, although some of the wood structures, mostly one story in height, were located between them (Fig. 19). Nevertheless, it did not appear probable that fire spread from the wood structures to the fire-resistive buildings. There was a fair distance from the exposing buildings to the reinforced-concrete structures, whose exterior doors, window casings, and frames were of steel. These reasons and the nature of the fire damage in the fire-resistant buildings were thought to be satisfactory evidence of primary causes for the fire.

j. Fire protection for the group was furnished by 2- and 3-inch standpipe lines with 1½-inch hose in the main buildings. There were numerous small static tanks and a supply of portable hand pumps. No yard hydrant or public hydrant system could be located. Two-gallon, soda-acid fire extinguishers were distributed throughout the area, as were concrete and wood containers filled with sand. A few 5-gallon water pump tanks were in evidence.

k. No organized attempt had been made to combat the fires. Public fire apparatus could not reach the group because of fires along the roads leading to the buildings and debris on the roads

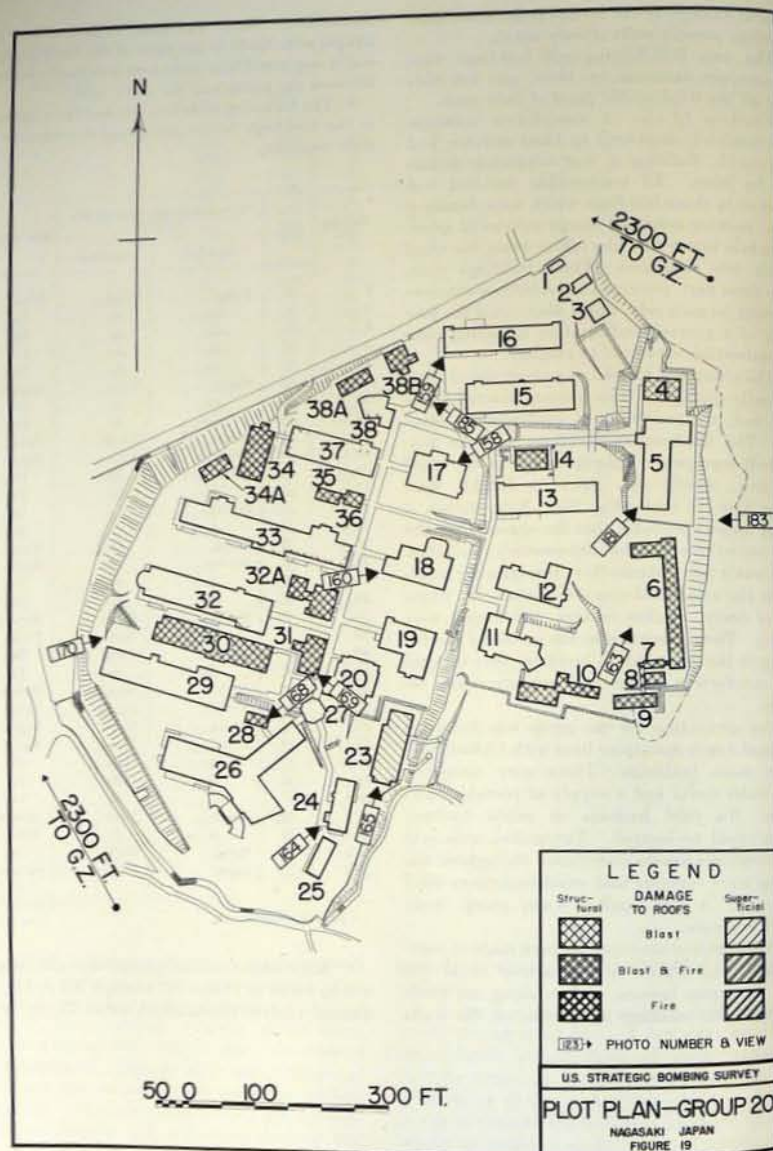
themselves. There was some evidence that attempts were made to use some of the hand pumps, and it was noted that some hose was partly burned between the pump and the static tank.

l. The following table lists fire and blast damage to the buildings in the group and fire damage to their contents.

Building No.	Fire Class	Estimated damage, blast and fire, buildings		Fire, contents
		Superficial	Structural	
6.	C	Total	Total	Total
7.	C	do.	do.	Do.
8.	C	do.	do.	Do.
9.	C	do.	do.	Do.
10.	C	do.	do.	Do.
11.	R	Slight	None	Slight
12.	R	do.	do.	Do.
13.	R	do.	do.	Do.
14.	C	Total	Total	Total
15.	R	Slight	None	Slight
16.	R	Moderate	do.	Do.
17.	R	do.	do.	Do.
18.	R	Severe	do.	Do.
19.	R	do.	do.	Do.
20.	R	Total	do.	Total
24.	R	Severe	do.	Slight
25.	R	do.	do.	Do.
26.	R	do.	do.	Do.
28.	(?)	Slight	Slight	Serious
29.	R	do.	None	Total
30.	C	Total	Total	Do.
31.	C	do.	do.	Do.
32.	R	Slight	None	Severe
32A.	C	Total	Total	Total
33.	R	Slight	None	Slight
34.	C	Total	Total	Total
34A.	C	do.	do.	Do.
35.	C	do.	do.	Do.
36.	C	do.	do.	Do.
37.	R	Slight	None	Moderate
38.	R	do.	do.	Total
38A.	C	Total	Total	Do.
38B.	(?)	Slight	None	Severe

¹ Roof C, balance N.

l. Additional details of construction and damage will be found in Photos 157 through 205 and in the damage analysis sheets which follow Figure 19.

**DAMAGE ANALYSIS**

Dimensions: 11 ft. by 25 feet.
Ground floor area: 275 square feet.
Total area: 275 square feet.
Number of floors: 1.
Eave height: 10 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 1.
Occupancy: Gatehouse.
Building type: Reinforced concrete (D).
Fire classification: R.
Ground zero: 2,000 feet.

Construction	Damage		Cause	Description of damage
	Struc- tural (per- cent)	Super- ficial (per- cent)		
Roof: Reinforced-concrete slab	0	0		
Trusses: None	0	0		
Columns: None	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	5	Blast	Slight crack west, north, and east walls approximately 8 feet from floor.
Interior walls: None	0	0		
Windows: Plain glass, metal frame	0	100	Blast	Glass broken, frames bent.
Finish: Plaster, wood floors	0	0		
Contents: Furniture	0	0		

Remarks: No structural damage.

DAMAGE ANALYSIS

Dimensions: 16 by 30 feet.
Ground floor area: 480 square feet.
Total area: 480 square feet.
Number of floors: 1.
Eave height: 12 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 2.
Occupancy: Morgue.
Building type: Reinforced concrete (D).
Fire classification: R.
Ground zero: 2,000 feet.

Construction	Damage		Cause	Description of damage
	Struc- tural (per- cent)	Super- ficial (per- cent)		
Roof: Reinforced-concrete slab	0	0		
First floor: Concrete on earth	0	0		
Foundation: Reinforced concrete	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Reinforced concrete	0	0		
Windows: Wood lath and plaster	0	100	Blast	
Finish: Plain glass, wood frames	0	100	do	
Finish: Plaster hung ceilings	0	100	do	

Remarks: No structural damage.

DAMAGE ANALYSIS

Dimensions: 25 by 25 feet.
Ground floor area: 625 square feet.
Total area: 625 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 3.
Occupancy: Lumber room.
Building type: Reinforced concrete (D).
Fire classification: R.
Ground zero: 2,000 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab.....	0	0		
First floor: Concrete on earth.....	0	0		
Foundation: Reinforced concrete.....	0	0		
Exterior walls: Reinforced concrete.....	0	0		
Windows: Plain glass, metal frames.....	0	100	Blast	Glass broken, frames bent.

Remarks: No structural damage.

DAMAGE ANALYSIS

Dimensions: 55 by 30 feet.
Ground floor area: 1,650 square feet.
Total area: 1,650 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 70 feet.

Group 20.
Building No. 4.
Occupancy: Pumping room.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,100 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast	
Trusses: Wood.....	100	0	do	
First floor: Wood joist and flooring.....	100	0	do	
Foundation: Reinforced concrete.....	10	0	do	
Exterior walls: Wood studs, metal lath and stucco.....	100	0	do	
Interior walls: Wood lath and plaster.....	0	100	do	
Windows: Plain glass, wood frames.....	0	100	do	
Finish: Plaster.....	0	100	do	

Remarks: Building completely demolished by atomic bomb. No fire.

DAMAGE ANALYSIS

Dimensions: 70 by 130 feet over all.
Ground floor area: 6,400 square feet.
Total area: 12,800 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 70 feet.

Group 20.
Building No. 5.
Occupancy: Psychopathic ward.
Building type: Reinforced concrete (E2).
Fire classification: R.
Ground zero: 2,100 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab.....	0	0		
Columns: Reinforced concrete.....	0	0		
Second floor: Reinforced-concrete slab.....	0	0		
First floor: Concrete on earth.....	0	0		
Foundation: Reinforced concrete.....	0	0		
Exterior walls: Reinforced concrete.....	0	50	Blast	
Interior walls: Lath and plaster between columns.....	0	100	do	
Windows: Steel frames, plain glass.....	0	75	do	
Finish: Hung ceilings; wood flooring; plaster walls.....	0	0		
Contents: Hospital furniture.....	0	0		

Remarks: No damage to reinforced-concrete frame; Superficial damage only by atomic bomb. No fire damage. Photos 163 and 181.

DAMAGE ANALYSIS

Dimensions: See plot plan.
Ground floor area: 5,250 square feet (3 buildings).
Total area: 5,250 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 70 feet.

Group 20.
Buildings Nos. 6, 7, 8.
Occupancy: Nurses' quarters.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile and wood sheathing.....	0	100	Blast and fire	
Trusses: Wood.....	100	0	do	
First floor: Wood joist and flooring.....	100	0	do	
Foundation: Concrete.....	75	0	do	
External walls: Wood and stucco.....	100	0	do	
Windows: Wood frames, plain glass.....	0	100	do	
Finish: Not known.....	0	0		
Contents: Furniture.....	100	0	Blast and fire	

Remarks: Completely destroyed by blast and fire caused by atomic bomb. Photo 203.

DAMAGE ANALYSIS

Dimensions: 20 by 65 feet.
Ground floor area: 1,300 square feet.
Total area: 1,300 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 70 feet.

Group 20.
Building No. 9.
Occupancy: Kitchen.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire	
Trusses: Wood.....	100	0	do	
First floor: Wood joist and flooring.....	100	0	do	
Foundation: Concrete.....	10	0	do	
Exterior walls: Wood and stucco.....	100	0	do	
Windows: Wood frames, plain glass.....	0	100	do	
Finish: Not known.....	0	0		
Contents: Kitchen equipment.....	100	0	Blast and fire	

Remarks: Completely destroyed by blast and fire caused by atomic bomb. Photo 203.

DAMAGE ANALYSIS

Dimensions: 50 by 120 feet over all.
Ground floor area: 1,600 square feet.
Total area: 1,600 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 70 feet.

Group 20.
Building No. 10.
Occupancy: Tubercular ward.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire	
Trusses: Wood.....	100	0	do	
First floor: Wood joist and flooring.....	100	0	do	
Foundation: Concrete.....	90	0	do	
Exterior walls: Wood and stucco.....	0	100	do	
Windows: Wood frames, plain glass.....	0	100	do	
Finish: Not known.....	0	0		
Contents: Not known.....	0	0		

Remarks: Completely destroyed by blast and fire caused by atomic bomb. Photo 203.

DAMAGE ANALYSIS

Dimensions: 70 by 100 feet over all.
Ground floor area: 3,000 square feet.
Total area: 6,000 square feet.
Number of floors: 2.
Eave height: 40 feet.
Mean elevation: 70 feet.

Group 20.
Building No. 11.
Occupancy: Tubercular ward.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab.....	0	0		
Columns: Reinforced concrete.....	0	0		
Second floor: Reinforced-concrete slab.....	0	0		
First floor: Concrete.....	0	0		
Foundation: Concrete.....	0	0		
Exterior walls: Reinforced concrete.....	0	0		
Interior walls: Lath and plaster between columns.....	0	0		
Windows: Steel frames, plain glass.....	0	100	Blast	All window glass broken; some frames bent.
Finish: Wood flooring; plaster walls and ceilings.....	0	100	do	Hung ceilings fallen; plaster cracked.
Contents: Furniture.....	0	0		

Remarks: No damage to reinforced-concrete frame of building. No fire. Photo 173.

DAMAGE ANALYSIS

Dimensions: 60 by 100 feet over all.
Ground floor area: 3,840 square feet.
Total area: 7,680 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 12.
Occupancy: Epidemic ward.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Basement: Concrete floor	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	50	Blast	Plaster fallen.
Interior walls: Lath and plaster between columns	0	100	do	All glass broken; all frames bent.
Windows: Plain glass; steel frames	0	75	do	All hung ceilings collapsed.
Finish: Wood flooring; hung ceilings; plaster walls	0	0		
Contents: Hospital furniture	0	0		

Remarks: No damage to reinforced-concrete frames of building. No fire. Photo 172.

DAMAGE ANALYSIS

Dimensions: 150 by 45 feet.
Ground floor area: 6,750 square feet.
Total area: 13,500 square feet.
Number of floors: 2.
Eave height: 40 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 13.
Occupancy: Urological ward.
Building type: Reinforced concrete (E2).
Fire classification: R.
Ground zero: 2,250 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	20	Blast and fire	
Interior walls: Lath and plaster between columns	0	100	Blast	
Windows: Steel frames; plain glass	0	95	Blast and fire	All hung ceilings destroyed.
Finish: Wood flooring, wood and plaster finish; hung ceilings	0	0		Fire destroyed wood trim north side of first floor.
Contents: Hospital furniture	0	0		

Remarks: No damage to reinforced-concrete frame. Photo 174.

DAMAGE ANALYSIS

Dimensions: 46 by 28 feet.
Ground floor area: 1,288 square feet.
Total area: 1,288 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 60 feet.

Group 20.
Building No. 14.
Occupancy: Clinic room.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0	do	
First floor: Wood joist and flooring	100	0	do	
Foundation: Concrete	75	0	do	
Exterior walls: Wood and stucco	100	0	do	
Windows: Wood frames, plain glass	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	100	0	do	

Remarks: Completely destroyed by blast and fire, by atomic bomb.

DAMAGE ANALYSIS

Dimensions: 45 by 160 feet.
Ground floor area: 7,200 square feet.
Total area: 14,400 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 15.
Occupancy: Ophthalmic ward.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Basement: Concrete floor	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Lath and plaster between columns	0	10	Blast	Some interior walls destroyed.
Windows: Steel frames, plain glass	0	100	do	All glass broken.
Finish: Hung ceilings; wood and plaster finish; wood flooring.	0	50	do	Hung ceilings fallen. Plaster cracked.
Contents: Hospital furniture	0	0		

Remarks: No damage to reinforced-concrete frame. No fire. Photo 175.

DAMAGE ANALYSIS

Dimensions: 35 by 175 feet.
Ground floor area: 6,125 square feet.
Total area: 12,250 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 60 feet.

Group 20.
Building No. 16.
Occupancy: Pediatrics ward.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,100 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced-concrete 5-inch parapet walls.	01	0	Blast	Parapet wall broken off at flashing line—10 feet.
Interior walls: Lath and plaster between columns.	0	05	do	
Windows: Steel frames, plain glass	0	100		All glass broken; some frames bent.
Finish: Hung ceilings; plaster on wood lath; wood flooring.	0	50		All hung ceilings down.
Contents: Hospital furniture	0	0		

Remarks: No damage to reinforced-concrete frame. No fire. Photo 159.

DAMAGE ANALYSIS

Dimensions: 60 by 80 feet over-all.
Ground floor area: 3,344 square feet.
Total area: 5,168 square feet.
Number of floors: 2.
Eave height: 35 feet.
Mean elevation: 50 feet.

Group 20.
Building No. 17.
Occupancy: Operating rooms.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: 4-inch reinforced-concrete slab, 12- by 16-inch reinforced-concrete beams.	25	0	Blast	
Columns: Reinforced concrete	20	0	do	
Second floor: Reinforced-concrete slab.	15	0	do	
First floor: Concrete	15	0	do	
Foundation: Concrete	5	0	do	
Exterior walls: Reinforced-concrete	25	0	do	
Interior walls: One reinforced concrete, first floor lath and plaster.	0	75	do	
Windows: Steel frames, plain glass	0	100	do	
Finish: Wood and plaster trim	0	50	do	
Contents: Hospital furniture	0	0	do	

Remarks: All structural damage done by 500-pound high-explosive bomb. Atomic bomb caused only additional damage to interior walls and finish. Photos 158, 176, and 182.

DAMAGE ANALYSIS

Dimensions: 70 by 100 feet over-all.
Ground floor area: 4,100 square feet.
Total area: 6,600 square feet.
Number of floors: 2.
Eave height: 40 and 22 feet.
Mean elevation: 50 feet.

Group 20.
Building No. 18.
Occupancy: Operation rooms.
Building type: Reinforced concrete (E1).
Fire classification: R.
Grounds zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	5	20	Blast	
Columns: Reinforced concrete	5	0	do	
Second floor: Reinforced-concrete slab.	5	0	do	
First floor: Concrete	5	0	do	
Foundation: Concrete	5	0	do	
Exterior walls: Reinforced concrete	40	0	do	
Interior walls: Lath and plaster	0	50	do	
Windows: Metal frames, plain glass	0	100	do	All glass broken. Metal frames distorted. Plaster cracked and fallen.
Finish: Wood and plaster trim	0	50	do	
Contents: Hospital furniture	0	0	do	

Remarks: All structural damage done by 500-pound high-explosive bomb. Atomic bomb caused additional damage to windows and plaster. Photos 160, 162, and 192.

DAMAGE ANALYSIS

Dimensions: 70 by 80 feet over-all.
Ground floor area: 4,600 square feet.
Total area: 9,200 square feet.
Number of floors: 2.
Eave height: 40 feet.
Mean elevation: 50 feet.

Group 20.
Building No. 19.
Occupancy: Orthopedic ward.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,300 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Basement: Concrete floor	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Lath and plaster	0	90	Blast and fire	All glass broken. Frames distorted.
Windows: Steel frames, plain glass	0	100	do	
Finish: Wood and plaster	0	95	do	
Contents: Hospital furniture	0	0		Wood trim burned except in 2 rooms.

Remarks: No structural damage to reinforced-concrete frame. All damage done by blast and fire.
Photo 193.

DAMAGE ANALYSIS

Dimensions: 65 by 50 feet.
Ground floor area: 3,250 square feet.
Total area: 6,500 square feet.
Number of floors: 2.
Eave height: 50 feet.
Mean elevation: 50 feet.

Group 20.
Building No. 20.
Occupancy: Clinic rooms.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,300 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	100	Fire	All glass broken and frames distorted.
Interior walls: Lath and plaster	0	100	Blast and fire	
Windows: Steel frames, plain glass	0	100	do	
Finish: Wood and plaster trim; hung ceilings	0	100	do	
Contents: Furniture	0	0		

Remarks: No damage to reinforced-concrete frame. All wood and plaster trim destroyed by fire.
Photo 161.

DAMAGE ANALYSIS

Dimensions: 100 by 42 feet.
Ground floor area: 4,200 square feet.
Total area: 4,200 square feet.
Number of floors: 1.
Eave height: 24 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 23.
Occupancy: Boiler house.
Building type: Steel frame (D).
Fire classification: N.
Ground zero: 2,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Corrugated asbestos on steel purlins	0	100	Blast	All corrugated asbestos roofing gone.
Trusses: Light steel	0	0		
Columns: 6- by 10-inch rolled I-beams	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete piers	0	0		
Exterior walls: Corrugated asbestos	0	100	Blast	All siding destroyed.
Windows: Glass in steel frames	0	100	do	All glass broken.
Contents: Boilers and pumps	0	0		

Remarks: No structural damage. Photo 165.

DAMAGE ANALYSIS

Dimensions: 30 by 80 feet.
Ground floor area: 2,400 square feet.
Total area: 4,800 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 24.
Occupancy: Kitchen.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced concrete	0	0		
First floor: Reinforced concrete	0	0		
Basement: Concrete floor	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Lath and plaster	0	100	Blast and fire	Pushed over by blast and burned.
Windows: Steel frames, plain glass	0	100	do	All glass broken and frames distorted.
Finish: Wood trim and plaster	0	100	do	Plaster fallen and wood trim burned.
Contents: Furniture	0	0		

Remarks: No structural damage to reinforced-concrete frame. Damage to interior caused by blast and fire. Photos 164, 166, 194, and 200.

DAMAGE ANALYSIS

Dimensions: 60 by 20 feet.
Ground floor area: 1,200 square feet.
Total area: 2,400 square feet.
Number of floors: 2.
Eave height: 28 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 25.
Occupancy: Laundry.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,500 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Lath and plaster on wood	0	0		
Windows: Steel frame, plain glass	0	100	Blast and fire	All glass broken and frames distorted.
Finish: Wood trim, plaster	0	100	do	Trim destroyed by fire.
Contents: Laundry equipment	50	0	do	

Remarks: No damage to reinforced-concrete frame. Interior burned throughout.

DAMAGE ANALYSIS

Dimensions: 160 by 200 feet over all.
Ground floor area: 12,200 square feet.
Total area: 36,600 square feet.
Number of floors: 3.
Eave height: 42 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 26.
Occupancy: Administration building.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab.....	0	0		
Columns: Reinforced concrete.....	0	0		
Third floor: Reinforced-concrete slab.....	0	0		
Second floor: Reinforced-concrete slab.....	0	0		
First floor: Reinforced-concrete slab.....	0	0		
Basement: Concrete floor.....	0	0		
Foundation: Concrete.....	0	0		
Exterior walls: Reinforced concrete.....	0	90	Blast and fire	Fire on all floors.
Interior walls: Lath and plaster on wood.....	0	100	do	All glass broken and frames distorted.
Windows: Steel frames, plain glass.....	0	100	do	Hung ceilings fallen from blast. Trim destroyed by fire.
Finish: Wood trim and plaster walls; hung ceilings.....	0	0		
Contents: Hospital furniture.....	0	0		

Remarks: No damage to reinforced-concrete frame. Photos 167 and 201.

DAMAGE ANALYSIS

Dimensions: 33 by 15 feet.
Ground floor area: 495 square feet.
Total area: 495 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 28.
Occupancy: Warehouse.
Building type: load-bearing brick (D).
Fire classification: C and N.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast and fire	
Trusses: Wood.....	100	0	do	
First floor: Wood joist and flooring.....	100	0	do	
Foundation: Concrete.....	10	0	do	
Exterior walls: 13-inch brick.....	40	0	do	
Windows: Wood frames, plain glass.....	0	100	do	Glass broken. Frames burned.
Finish: Not known.....	0	0		

Remarks: Complete structural damage. Photos 168 and 205.

DAMAGE ANALYSIS

Dimensions: 45 by 200 feet.
Ground floor area: 9,000 square feet.
Total area: 27,000 square feet.
Number of floors: 3.
Eave height: 52 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 29.
Occupancy: Wards.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab.....	0	0		
Columns: Reinforced concrete.....	0	0		
Third floor: Reinforced-concrete slab.....	0	0		
Second floor: Reinforced-concrete slab.....	0	0		
First floor: Reinforced-concrete slab.....	0	0		
Basement: Concrete floor.....	0	0		
Foundation: Concrete.....	0	0		
Exterior walls: Reinforced-concrete walls 8-inch parapet walls.....	5	0	Blast	Broken off at roof flashing line and fallen away from atomic bomb.
Interior walls: Lath and plaster on wood.....	0	25	Blast and fire	Walls blasted and burned.
Windows: Steel frames, plain glass.....	0	100	do	All glass broken and frames distorted.
Finish: Wood trim and plaster; hung ceilings.....	0	100	do	
Contents: Hospital furniture.....	0	0		

Remarks: Only damage to reinforced-concrete frame is to parapet wall as shown. Fire extends over all floors. Photos 170 and 171.

DAMAGE ANALYSIS

Dimensions: 40 by 185 feet.
Ground floor area: 7,400 square feet.
Total area: 7,400 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 45 feet.

Group 20.
Building No. 30.
Occupancy: Infirmary.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0		
First floor: Wood joist and flooring	100	0		
Foundation: Brick and stone	10	0		
Exterior walls: Wood and stucco	100	0		
Windows: Wood frames, plain glass	0	100		
Finish: Not known	0	0		
Contents: Not known	0	0		

Remarks: Completely destroyed by blast and fire. Photo 202.

DAMAGE ANALYSIS

Dimensions: 30 by 60 feet.
Ground floor area: 1,800 square feet.
Total area: 1,800 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 45 feet.

Group 20.
Building No. 31.
Occupancy: Shops.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,200 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing	0	100		
Trusses: Wood	100	0		
First floor: Wood joist and flooring	100	0		
Foundation: Concrete	10	0		
Exterior walls: Wood and stucco	100	0		
Interior walls: Wood	0	0		
Windows: Wood frame, plain glass	0	100		
Finish: Not known	0	100		
Contents: Not known	0	0		

Remarks: Completely destroyed by blast and fire.

DAMAGE ANALYSIS

Dimensions: 45 by 200 feet.
Ground floor area: 9,000 square feet.
Total area: 27,000 square feet.
Number of floors: 3.
Eave height: 54 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 32.
Occupancy: Wards.
Building Type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 2,100 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: 4-inch reinforced-concrete slab	0	5	Blast	
Columns: 21- by 21-inch reinforced concrete	5	0	do	
Third floor: 4-inch reinforced-concrete slab	5	0	do	
Second floor: 4-inch reinforced-concrete slab	0	0	do	
First floor: Concrete	0	0	do	
Foundation: Concrete	5	0	do	
Exterior walls: Reinforced-concrete 8-inch parapet wall				30 feet of parapet wall cracked off at flashing line away from atomic bomb.
Interior walls: Lath and plaster	20	0	do	
Windows: Metal frame, plain glass	0	100	do	
Finish: Wood trim and plaster.	0	100	do	
Hung ceilings				
Contents: Hospital furniture	0	0		

Remarks: All structural damage, except to parapet walls, caused by 500-pound high-explosive bombs. Photos 169, 177, 186, 187, 188, 189, 190, 191, 197, and 199.

DAMAGE ANALYSIS

Dimensions: See plot plan.
Ground floor area: 8,900 square feet.
Total area: 8,900 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 45 feet.

Group 20.
Building No. See remarks below.
Occupancy: Wards and offices.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,000 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0		
First floor: Wood flooring, wood joist	0	100		
Foundation: Concrete and brick walls	25	0		
Exterior walls: Stucco and wood siding and frames	100	0		
Interior walls: Not known	0	100		
Windows: Plain glass, wood frames	0	100		
Finish: Not known	0	0		
Contents: Not known	0	0		

Remarks: Buildings included on this sheet 32A, 34, 34A, 35, 36, 38A. All these buildings destroyed by blast and fire. Photo 182.

DAMAGE ANALYSIS

Dimensions: 40 by 265 feet over all.
Ground floor area: 10,600 square feet.
Total area: 31,800 square feet.
Number of floors: 3.
Eave height: 45 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 33.
Occupancy: Surgical ward.
Building type: Reinforced concrete (E1.)
Fire classification: R.
Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Third floor: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: 8-inch reinforced concrete	0	0		
Interior walls: Wood lath and plaster	0	20	Blast and fire	Plaster off, trim burned.
Windows: Plain glass, steel frames	0	100	do	All glass broken by blast.
Finish: Wood trim and plaster; hung ceilings	0	60	do	Ceilings fallen, trim burned.
Contents: Hospital furniture	0	0		Fire destroyed approximately 25 percent.

Remarks: No structural damage to this building. Fire and blast caused superficial damage. Photo 178.

DAMAGE ANALYSIS

Dimensions: 43 by 138 feet.
Ground floor area: 5,934 square feet.
Total area: 14,835 square feet.
Number of floors: 2 and 3.
Eave height: 45 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 37.
Occupancy: Wards.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Third floor: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Foundation: Concrete walls	0	10		Parapet capping blown over on roof.
Exterior walls: Reinforced concrete	0	25	Blast and fire	Plaster and wire lath blown off.
Interior walls: Wood lath and plaster	0	100	do	
Windows: Plain glass, metal frames	0	100	do	
Finish: Wood trim and plaster; hung ceilings	0	0		
Contents: Hospital furniture				

Remarks: No structural damage to this building. Superficial damage by blast and fire. Photos 179, 182, 195, and 196.

DAMAGE ANALYSIS

Dimensions: 45 by 60 feet over all.
Ground floor area: 2,000 square feet.
Total area: 2,000 square feet.
Number of floors: 1.
Eave height: 20 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 38.
Occupancy: Clinic.
Building type: Reinforced concrete (D).
Fire classification: R.
Ground zero: 1,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
First floor: Reinforced-concrete slab	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Reinforced concrete with 4-foot parapet	30	0	Blast	
Interior walls: Wood lath and plaster	0	25	Blast and fire	
Windows: Plain glass, metal frames	0	100	do	
Finish: Wood trim and plaster	0	100	do	
Contents: Not known	0	0		

Remarks: Only structural damage to parapet walls, broken at roof line. All superficial damage by blast and fire. Photos 180, 184, and 198.

DAMAGE ANALYSIS

Dimensions: 30 by 50 feet over all.
Ground floor area: 1,200 square feet.
Total area: 1,200 square feet.
Number of floors: 1.
Eave height: 20 feet.
Mean elevation: 45 feet.

Group 20.
Building No. 38B.
Occupancy: Boiler room.
Building type: Load-bearing brick (D).
Fire classification: Roof C, remainder N.
Ground zero: 1,900 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	
Trusses: Wood	100	0	do	
First floor: Concrete on earth	0	0		
Foundation: Brick walls	0	0		
Exterior walls: 13-inch brick walls	90	0		
Windows: Plain glass, wood frames	0	100		
Contents: Boilers	40	0		

Remarks: Only west end wall remained standing. Remainder of building demolished by blast and fire. Photo 185.

17. Private Mitsubishi Boys Industrial School,
Group 21; Mitsubishi Nagasaki Workers
Club, Group 22

a. Group 21 was comprised of 12 buildings and an area which housed backyard industries and dwellings. Group 22 was comprised of 10 buildings. These groups were located from 1,600 to 2,400 feet south of GZ (Fig. 18).

b. The buildings in both groups were wood-frame types, and wood construction predominated in the area which housed backyard industries and dwellings. The occupancy of most of the buildings

was light machine shops, a dispensary, a canteen, lavatories, barracks, and dwellings. The total plan area of the buildings in Group 21 was 49,603 square feet and the total floor area was 56,313 square feet. The total plan and floor area of Group 22 is unknown.

c. All of the buildings on both sites were destroyed by blast and fire, with the exception of a few of the foundations. The probable cause of the majority of the initial fires was primary.

d. Further information is contained in the damage analysis sheets which follow.

DAMAGE ANALYSIS

Dimensions: 192 by 61 feet.
Ground floor area: 11,712 square feet.
Total area: 11,712 square feet.
Number of floors: Not known.
Eave height: Not known.
Mean elevation: 10 feet.

Group 21.
Building No. 1.
Occupancy: Light machine shop.
Building type: Wood (A2.1).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile.....	0	100	Blast and fire...	
Trusses: Wood.....	100	0	do.....	
Columns: Wood.....	100	0	do.....	
First floor: Concrete on earth.....	0	0	do.....	
Foundation: Reinforced concrete 12 inches thick.....	0	10	Fire and blast...	
Exterior walls: Metal lath and stucco.....	0	100	Blast and fire...	
Interior walls: Metal lath and stucco.....	0	100	do.....	
Windows: Wood.....	0	100	do.....	
Contents: Machine tools.....	0	90	do.....	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: 109 by 61 feet.
Ground floor area: 6,649 square feet.
Total area: 6,649 square feet.
Number of floors: Not known.
Eave height: Not known.
Mean elevation: 10 feet.

Group 21.
Building No. 2.
Occupancy: Machine shop.
Building type: Wood (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile.....	0	100	Blast and fire...	
First floor: Concrete on earth.....	0	0	do.....	
Foundation: 12-inch concrete wall.....	0	10	do.....	
Exterior walls: Metal lath and stucco.....	100	0	Blast and fire...	
Windows: wood.....	0	100	do.....	
Contents: Machine tools.....	0	90	do.....	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: 110 by 61 feet each.
Ground floor area: 6,710 square feet each.
Total area: 13,420 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10 feet.

Group 21.
Building Nos. 3 and 4.
Occupancy: Light machines.
Building type: Wood (D).
Fire classification: C.
Ground zero: 1,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile.....	0	100	Blast and fire...	
First floor: Concrete on earth.....	0	0	do.....	
Foundation: Reinforced concrete 12 inches thick.....	0	10	Blast and fire...	
Exterior walls: Wood.....	100	0	do.....	
Interior walls: Wood.....	0	100	do.....	
Windows: Wood sash.....	0	100	do.....	
Contents: Machine tools.....	0	90	do.....	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: 40 by 18 feet.
Ground floor area: 720 square feet.
Total area: 720 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10 feet.

Group 21.
Building No. 5.
Occupancy: Latrine.
Building type: Wood (D).
Fire classification: C.
Ground zero: 1,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile	0	100	Blast and fire	
First floor: Concrete and tile on earth	25	0	do	
Foundation: 12-inch reinforced concrete	10	0	do	
Exterior walls: Wood	100	0	do	
Interior walls: Wood	0	100	do	
Windows: Wood sash	0	100	do	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: 48 by 24 feet.
Ground floor area: 1,152 square feet.
Total area: 1,152 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10 feet.

Group 21.
Building No. 6.
Occupancy: Forge and repair shop.
Building type: Wood (D).
Fire classification: C.
Ground zero: 1,600 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile	0	100	Blast and fire	
First floor: Concrete on earth	10	0	do	
Foundation: 12-inch concrete wall	5	0	do	
Exterior walls: Wood	100	0	do	
Interior walls: Wood	0	100	do	
Windows: Wood sash	0	100	do	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: 32 by 22 feet.
Ground floor area: 700 square feet.
Total area: 700 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10.

Group 21.
Building No. 7.
Occupancy: Boiler house.
Building type: Wood (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile	0	100	Blast and fire	
First floor: Concrete on earth	10	0	do	
Foundation: 12-inch thick walls	5	0	do	
Exterior walls: Wood	100	0	do	
Interior walls: Wood	0	100	do	
Windows: Wood sash	0	100	do	
Contents: Boiler	0	90	do	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Ground floor area: 14,960 square feet.
Total area: 14,960 square feet.
Number of floors: Not known.
Eave Height: Not known.
Mean elevation: 10 feet.
Group 21.

Building Nos. 8, 9, 10, 11, and 12.
Occupancy: Recreation, dispensary, and canteen.
Building type: Various (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Wood and tile	0	100	Blast and fire	
First floor: Wood	100	0	do	
Foundation: 12-inch concrete wall	10	0	do	
Exterior walls: Stucco on metal lath	0	100	do	
Interior walls: Stucco on metal lath	0	100	do	
Windows: Wood sash	0	100	do	

Remarks: All damage by blast and fire.

DAMAGE ANALYSIS

Dimensions: Not known.
Ground floor area: 7,000 square feet.
Total area: 7,000 square feet.
Number of floors: Not known.
Eave height: Not known.
Mean elevation: 10 feet.

Group 21.
Building No.: Area (X).
Occupancy: Light machine shops.
Building type: Sheds, homes (D).
Fire classification: C.
Ground zero: 2,400 feet.

Description of damage: Back yard industries construction unknown. Completely demolished by blast and fire.

DAMAGE ANALYSIS

Mean elevation: 10 feet.
Group 22.
Buildings Nos. 1-10.
Occupancy: Barracks, etc.

Building type: (D).
Fire classification: C.
Ground zero: 2,400 feet.

Construction	Damage		Description of damage
	Structural (percent)	Superficial (percent)	
Roof: Wood and tile	0	100	Blast and fire
First floor: Wood	100	0	do
Foundation: 12-inch thick walls	10	0	do
Exterior walls: Wood	100	0	do
Interior walls: Wood	0	100	do
Windows: Wood sash	0	100	do

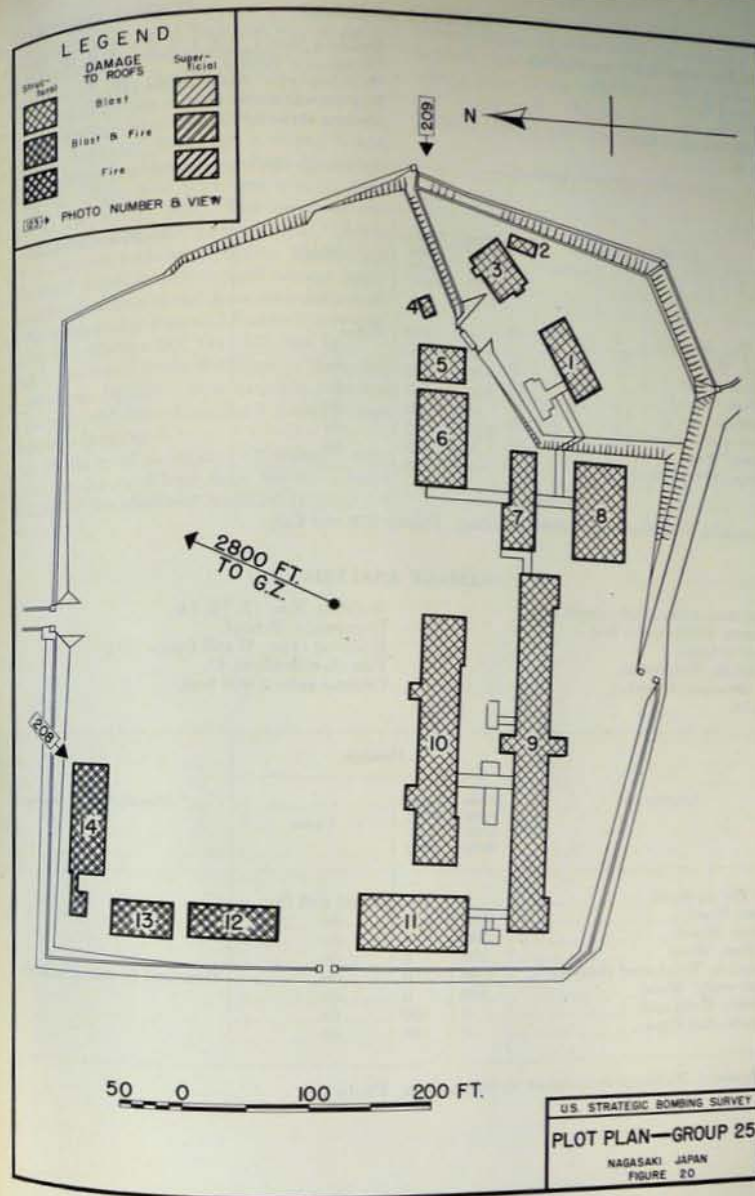
Remarks: All damage by blast and fire.

18. Keiho Boys' High School, Group 25

a. This group was situated approximately 2,800 feet southwest of GZ. It consisted of 14 buildings of wood-frame construction on concrete foundation walls. The roofs were tiled. The buildings were one story in height and covered a total plan area of approximately 11,400 square feet.

b. All of these buildings were damaged beyond repair. Buildings 12, 13, and 14 were destroyed by blast and fire. The remainder of the buildings were damaged by blast only.

c. The cause of the fire in the three buildings could not be determined. No data regarding fire protection were available.



DAMAGE ANALYSIS

Ground floor area: 9,400 square feet.
Total area: 9,400 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 40 feet.
Group 25.

Building Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.
Occupancy: School.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood	0	100	Blast	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Wood	100	0	do	
Foundation: Brick	40	0	do	
Exterior walls: Wood	100	0	do	
Windows: Wood sash	0	100	do	
Contents: Not known	0	0		

Remarks: Buildings demolished by blast. Photos 209 and 210.

DAMAGE ANALYSIS

Ground floor area: 2,000 square feet.
Total area: 2,000 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 40 feet.
Group 25.

Building Nos. 12, 13, 14.
Occupancy: School.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 2,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Wood	100	0	do	
Foundation: Reinforced concrete	40	0	do	
Interior walls: Wood	100	0	do	
Windows: Wood sash	0	100	do	
Contents: Not known	0	100	do	

Remarks: Buildings demolished to foundations. Photo 208.

19. Fuchi School, Group 27

a. This group of eight building was situated approximately 3,800 feet south-southwest of GZ. It consisted of one three-story, reinforced-concrete building (Building 1), one one-story concrete-steel building (Building 2), three two-story, wood-frame buildings (Buildings 5, 6, and 7) and three one-story, wood-frame buildings (Buildings 3, 4, and 8). The total plan area was approximately 61,400 square feet. The areas of the various buildings and their types were as follows: b. The concrete building (Building 1) sustained no structural damage, although all interior partitions and window frames and glass were destroyed. All of the combustible trim and contents were consumed by fire (Photos 213, 214, 217, and 218).

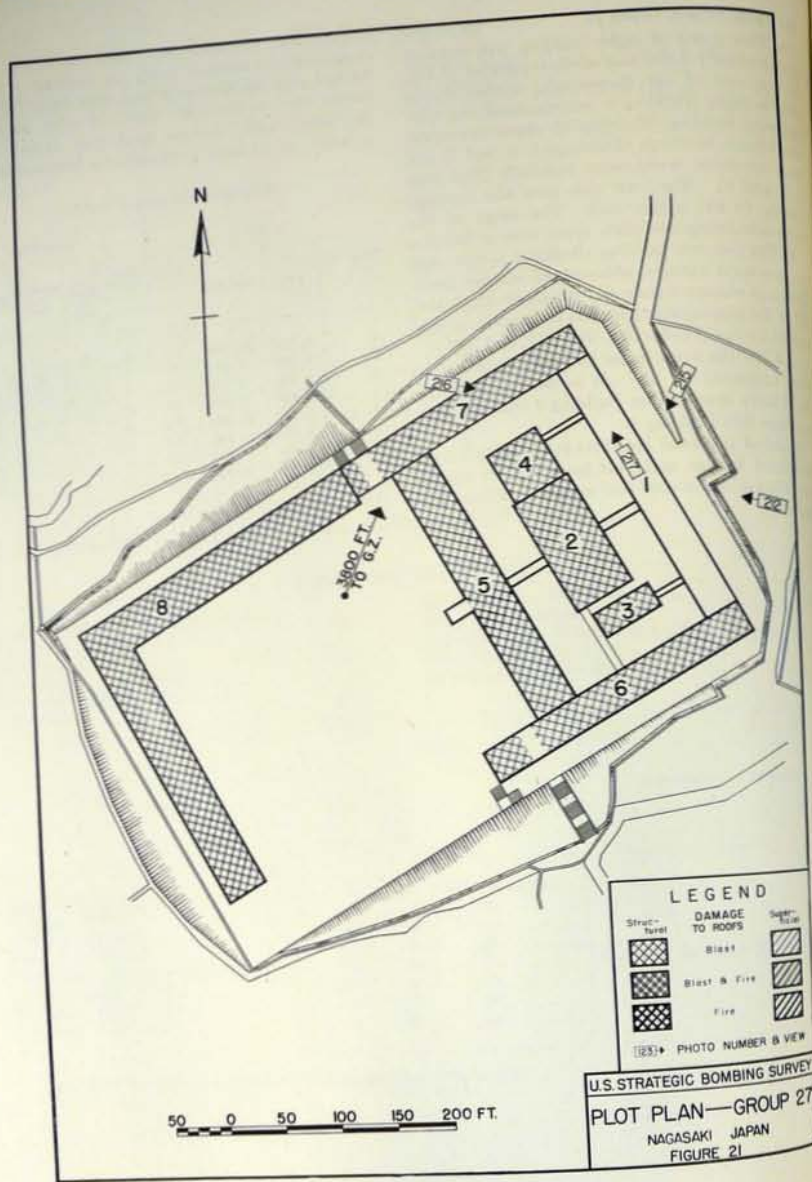
c. All of the wood-frame buildings in the group were consumed by fire. It is possible that fire could have spread from Building 7 through large openings into Building 1.

d. All of the wood members in Building 2 were destroyed by fire, and heat from the fire caused the collapse of the steel roof members (Photos 219 and 221).

e. It was observed that large areas of the cement-stucco exterior finish on building 1 had burned pink on the north and west sides. Protected areas of the walls were buff color, as was the south wall. Intense heat (not caused internally) could have produced this discoloration.

Building classification, Group 27

Bldg. No.	Area		Type	Fire class	Construction		
	Plan	Total floor			Reinforced concrete	Concrete and steel	Wood
1	8,228	24,684	E1	R	X		
2	5,995	5,995	D	C		X	
3	1,296	1,296	D	C			X
4	2,304	2,304	D	C			X
5	9,196	18,392	E2	C			X
6	8,064	16,128	E2	C			X
7	7,328	14,656	E2	C			X
8	19,076	19,076	A2.3	C			X
Total	61,487	102,531			1	1	6



DAMAGE ANALYSIS

Dimensions: 242 by 34 feet.
Ground floor area: 8,228 square feet.
Total area: 24,684 square feet.
Number of floors: 3.
Eave height: 45 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 1.
Occupancy: Classrooms, offices.
Building type: Reinforced-concrete frame (E1).
Fire classification: R.
Ground zero: 3,700 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Cement over waterproofing over reinforced-concrete slab and beams.	0	0		
Columns: Reinforced concrete, 24 by 24, 21 by 21, 18 by 18 inches.	0	0		
Third floor: Reinforced-concrete slab and beams.	5	0	Blast	Photo 214.
Second floor: Reinforced-concrete slab and beams.	5	0	do	
First floor: Reinforced-concrete slab and beams.	0	0		
Foundation: Reinforced-concrete footings.	0	0		
Exterior walls: Reinforced concrete.	0	40	Blast	Cracking of finish.
Interior walls: 25 percent reinforced concrete, 75 percent wood.	0	75	Blast and fire	All wood partitions burned.
Windows: Metal sash.	0	100	do	Blown out warped. Photos 215, 216, and 217.
Finish: Plaster and wood.	0	100	Fire	Burned out. Photos 213, 214, 217, and 218.
Contents: Furniture.	0	100	do	Consumed.

Remarks: Photos 211 through 218.

DAMAGE ANALYSIS

Dimensions: 109 by 55 feet.
Ground floor area: 5,995 square feet.
Total area: 5,995 square feet.
Number of floors: 1.
Eave height: 18 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 2.
Occupancy: Auditorium, gymnasium.
Building type: Steel and reinforced-concrete frame (D).
Fire classification: C.
Ground zero: 3,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Asbestos shingles, wood sheathing, steel purlins.	0	100	Blast and fire	Demolished, wood burned.
Trusses: Steel, modified Fink; 54 by 13½ feet, 12 feet center to center.	100	0	do	Knocked down, warped.
Columns: Reinforced concrete, 16 by 21 inches plus finish.	0	30	Fire	Cracks in finish.
First floor: Wood flooring and framing on reinforced-concrete piers.	100	0	do	Burned.
Foundation: Reinforced - concrete footings.	0	0		
Exterior walls: Reinforced concrete, 9 inches thick, including 1-inch finish each side.	30	40	Blast	Cracked.
Windows: Metal sash	0	100	Blast and fire	Blown out, warped.
Finish: Plaster, wood.	0	100	Fire	Burned out.
Contents: Furniture, gym equipment.	0	100	do	do.

Remarks: Photos 219 and 221.

DAMAGE ANALYSIS

Dimensions: 54 by 24 feet.
Ground floor area: 1,296 square feet.
Total area: 1,296 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 3.
Occupancy: Small gym (fencing).
Building type: Wood frame (D).
Fire Classification: C.
Ground zero: 3,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Asbestos shingles, wood sheathing, wood purlins.	0	100	Blast and fire	Demolished, burned.
Trusses: Wood, triangular, 24 by 6 feet, 6 feet center to center.	100	0	do	do.
Columns: Wood, 6 by 6 inches, 6 feet center to center.	100	0	do	
First floor: Wood flooring and framing.	100	0	do	
Foundation: Reinforced-concrete grade beams and interior piers on reinforced-concrete piles.	0	0		
Exterior walls: Wood frame, weatherboards.	0	100	Blast and fire	
Interior walls: Wood frame	0	100	do	
Windows: Sliding wood sash	0	100	do	
Finish: Wood; no ceiling	0	100	Fire	
Contents: Furniture	0	100	do	do.

Remarks: Nothing left but foundations.

DAMAGE ANALYSIS

Dimensions: 48 by 48 feet.
Ground floor area: 2,304 square feet.
Total area: 2,304 square feet.
Number of floors: 1.
Eave height: 13 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 4.
Occupancy: Lockers, showers, etc.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 3,800 feet.

Construction	Damage			Description of damage
	Struc- tural (per- cent)	Super- ficial (per- cent)	Cause	
Roof: Asbestos shingles, wood sheathing, rafters, purlins.	0	100	Blast and fire	Demolished, burned.
Trusses: Wood, triangular, 48 by 12 feet, 6 feet center to center.	100	0	do	do.
Columns: Wood, 8 by 8 inches, 6 feet center to center.	100	0	do	do.
First floor: 80 percent reinforced-concrete on earth, 20 percent wood flooring and framing.	20	0	Fire	Wood part burned.
Foundation: Reinforced-concrete grade beams and interior piers on reinforced-concrete piles.	0	0		
Exterior walls: Wood	0	100	Blast and fire	Demolished, burned.
Interior walls: Wood	0	100	do	do.
Windows: Sliding wood sash	0	100	do	do.
Finish: Wood	0	100	do	do.
Contents: Not available	0	100	do	do.

Remarks: Nothing left but foundations.

DAMAGE ANALYSIS

Dimensions: 242 by 38 feet.
Ground floor area: 9,196 square feet.
Total area: 18,392 square feet.
Number of floors: 2.
Eave height: 28 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 5.
Occupancy: Classrooms.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 3,800 feet.

Construction	Damage			Description of damage
	Struc- tural (per- cent)	Super- ficial (per- cent)	Cause	
Roof: Asbestos shingles, wood sheathing and purlins.	0	100	Blast and fire	Demolished, burned.
Trusses: Wood, triangular, 38 by 9½ feet, 6 feet center to center.	100	0	do	do.
Columns: Wood, 8 by 8 inches, 6 feet center to center.	100	0	do	do.
Second floor: Wood flooring and framing.	100	0	do	do.
First floor: Wood flooring and framing.	100	0	do	do.
Foundation: Reinforced-concrete grade beams and interior piers on reinforced-concrete piles.	0	0		
Exterior walls: Wood frame, weatherboards.	0	100	Blast and fire	do.
Interior walls: Wood frame	0	100	do	do.
Windows: Wood sash	0	100	do	do.
Finish: Wood, possibly some plaster	0	100	do	do.
Contents: School furniture	0	100	do	do.

Remarks: Nothing left but foundations and fireproof stair tower at rear.

DAMAGE ANALYSIS

Dimensions: 252 by 32 feet.
Ground floor area: 8,064 square feet.
Total area: 16,128 square feet.
Number of floors: 2.
Eave height: 28 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 6.
Occupancy: Classrooms.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 3,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Asbestos shingles, wood sheathing and purlins.	0	100	Blast and fire	Demolished, burned.
Trusses: Wood, triangular, 32 by 8 feet; 6 feet center to center.	100	0	do	do.
Columns: Wood, 8 by 8 inches; 6 feet center to center.	100	0	do	do.
Second floor: Wood flooring and framing.	100	0	do	do.
First floor: Wood flooring and framing.	100	0	do	do.
Foundation: Reinforced-concrete grade beams and interior piers on reinforced-concrete piles.	0	0		
Exterior walls: Wood frame, weatherboards.		100	Blast and fire	do.
Interior walls: Wood frame.	0	100	do	do.
Windows: Wood sash.	0	100	do	do.
Finish: Wood, possibly some plaster.	0	100	do	do.
Contents: School furniture.	0	100	do	do.

Remarks: Nothing left but foundations and fireproof stair tower.

DAMAGE ANALYSIS

Dimensions: 229 by 32 feet.
Ground floor area: 7,328 square feet.
Total area: 14,656 square feet.
Number of floors: 2.
Eave height: 28 feet.
Mean elevation: 100 feet.

Group 27.
Building No. 7.
Occupancy: Classrooms.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 3,700 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Asbestos shingles, wood sheathing and purlins.	0	100	Blast and fire	Demolished, burned.
Trusses: Wood, triangular 32 by 8 feet, 6 feet center to center.	100	0	do	do.
Columns: Wood, 8 by 8 inches, 6 feet center to center.	100	0	do	do.
Second floor: Wood flooring and framing.	100	0	do	do.
First floor: Wood flooring and framing.	100	0	do	do.
Foundation: Reinforced-concrete grade beams and interior piers on reinforced-concrete piles.	0	0		
Exterior walls: Wood frame, weatherboards.	0	100	Blast and fire	do.
Interior walls: Wood frame.	0	100	do	do.
Windows: Wood sash.	0	100	do	do.
Finish: Wood, possibly some plaster.	0	100	do	do.
Contents: School furniture.	0	100	do	do.

Remarks: Nothing left but foundations and fireproof stair tower. Photo 219.

DAMAGE ANALYSIS

Dimensions: 272 by 268 feet over all.
Ground floor area: 19,076 square feet.
Total area: 19,076 square feet.
Number of floors: 1.
Eave height: 15 feet.
Mean elevation: 110 feet.

Group 27.
Building No. 8.
Occupancy: Classrooms or shops.
Building type: Wood frame (A2.3).
Fire classification: C.
Ground zero: 3,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Asbestos shingles, wood sheathing and purlins.	0	100	Blast and fire	Demolished, burned.
Trusses: Wood, triangular 38 by 9½ feet, 6 feet center to center.	100	0	do.	do.
Columns: Wood, 6 feet center to center.	100	0	do.	do.
First floor: Wood flooring and framing.	100	0	do.	do.
Foundation: Reinforced-concrete grade beams and interior piers on reinforced-concrete piles.	0	0		
Exterior walls: Wood frame, weatherboards.	0	100	Blast and fire	do.
Interior walls: Wood frame.	0	100	do.	do.
Windows: Wood sash.	0	100	do.	do.
Finish: Wood, possibly some plaster.	0	100	do.	do.
Contents: School furniture.	0	100	do.	do.

Remarks: Nothing left but foundations. Photo 222.

20. Nagasaki Municipal Crematory, Group 28.

This building, located 5,100 feet southwest of GZ, was constructed of brick and marble. It was structurally damaged by blast.

21. Nagasaki Hygiene Experimental Center and Hospital, Group 29 for Contagious Diseases.

This group consisted of 22 buildings of various sizes all constructed of wood and located 4,900 feet southwest of GZ. All were destroyed by blast and fire (Photos 224 and 225).

22. Zenza School, Group 32

a. The seven buildings in this group were located 5,000 feet south of GZ. There were one three-story, reinforced-concrete building, two two-story, and three one-story wood-frame buildings. The wood-frame structures, covering a total area of 16,000 square feet, were completely destroyed by blast and fire, as were all the Japanese wooden homes in the area.

b. The three-story, reinforced-concrete building with an area of 8,340 square feet suffered no structural damage. The only form of damage suffered was limited to broken window glass and frames. At the time of the survey this building was being used as a hospital for contagious diseases.

23. Prisoner-of-War Camp (Saiwai Machi), Group 37

a. Seven buildings comprised this group which was located about 5,600 feet south of GZ. Total plan and floor areas were each 137,400 square feet. Buildings 1, 2, 4, 5, 6, and 7 were small, one-story wood structures. Building 3 was one story high, brick load-bearing type with a tile roof on wood supports. The function of this group prior to the war was probably that of a textile mill, but the buildings had been converted into a prisoner-of-war camp.

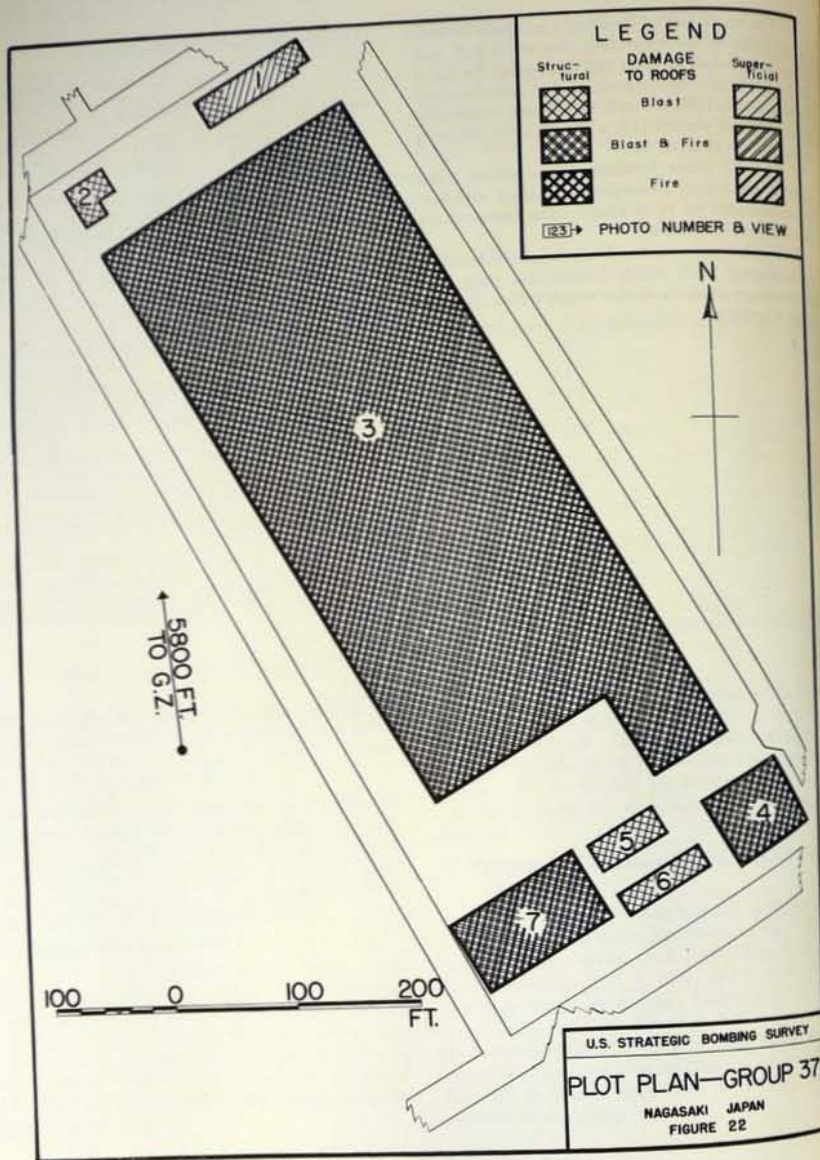
b. The north half of Building 3 had been cleared away prior to the inspection; the south half had been demolished by blast and fire, except for parts of the brick exterior walls which were still standing. In the south half, the row of columns nearest to GZ collapsed toward GZ, while all other columns collapsed away from it.

c. The six other buildings were almost completely destroyed, five-eighths by blast and fire, the remainder by blast alone. The cause of the fire was not determined.

d. Further information is given in the building classification table which follows this page, and the damage analysis sheets which follow the plot plan, Figure 22.

Building classification, Group 37

Building No.	Area		Type	Fire class	Construction	
	Plan	Total floor			Load-bearing wood	Wood
1	2,300	2,300	D	C		X
2	1,100	1,100	D	C		X
3	121,300	121,300	A1.1	C	X	
4	3,400	3,400	D	C		X
5 and 6	2,700	2,700	D	C		XX
7	6,600	6,600	D	C		X
Total	137,400	137,400			1	6



DAMAGE ANALYSIS

Dimensions: 96 by 25 feet overall.
Ground floor area: 2,300 square feet.
Total area: 2,300 square feet.
Number of floors: 1.
Roof height: 12 feet.
Mean elevation: 10 feet.

Group 37.
Building No. 1.
Occupancy: Office, telephone switchboard.
Building type: 1-story wood frame (D).
Fire classification: C.
Ground zero: 5,200 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile in mud on wood sheathing, rafters, and purlins.	0	80	Blast	Mostly still standing but canted out of plumb.
Trusses: Wood	50	0	do.	
Columns: Wood	100	0	do.	
First floor: Concrete	0	0		do.
Foundation: Concrete	0	0		
Exterior walls: Wood; weather-boarded.	0	100	Blast	
Interior walls: Wood	0	100	do.	do.
Windows: Wood sash	0	100	do.	
Finish: Plaster; wood trim	0	100	do.	
Contents: Furniture; switchboard	0	100	do.	

Remarks: Partly cleared away. No fire.

DAMAGE ANALYSIS

Dimensions: 36 by 36 feet over all.
Ground floor area: 1,100 square feet.
Total area: 1,100 square feet.
Number of floors: 1.
Roof height: Not available.
Mean elevation: 10 feet.

Group 37.
Building No. 2.
Occupancy: Toilets.
Building type: 1-story, wood frame (D).
Fire classification: C.
Ground zero: 5,300 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile in mud on wood sheathing rafters, and purlins.	0	100	Blast	
Trusses: Wood	100	0	do.	
Columns: Wood	100	0	do.	
First floor: Concrete	0	0		Concrete part undamaged, remainder 50 percent demolished.
Foundation: Concrete	0	0		
Exterior walls: Concrete to height of 4 feet; wood frame above, boarded.	0	50	Blast	
Interior walls: Wood	0	50	do.	
Windows: Wood sash	0	100	do.	
Finish: Wood boards	0	50	do.	
Contents: Toilets	0	100	do.	

Remarks: No fire.

DAMAGE ANALYSIS

Dimensions: 590 by 226 feet over all.
Ground floor area: 121,300 square feet.
Total area: 121,300 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 10 feet.

Group 37.
Building No. 3.
Occupancy: Light shop (?).
Building type: (A1.1) brick.
Fire classification: C.
Ground zero: 5,500 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile in mud, on wood sheathing, rafters, and purlins.	0	100	Fire and blast	
Trusses: Wood	100	0	do	
Columns: Steel, 6- by 6-inch headings.	100	0	do	
First floor: Concrete	0	20	Debris	
Foundation: Concrete	0	0	Blast	
Exterior walls: 12-inch brick load-bearing	80	0	do	
Interior walls: Concrete and brick load-bearing	80	0	do	
Windows: Wood sash	0	100	Fire and blast	
Contents: Not known	0	100	do	

Remarks: Half of building has been cleared away down to floor. Badly warped steel columns indicate intense fire.

DAMAGE ANALYSIS

Dimensions: 66 by 52 feet.
Ground floor area: 3,400 square feet.
Total area: 3,400 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10 feet.

Group 37.
Building No. 4.
Occupancy: Not known.
Building type: Wood-framed shed (D).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Corrugated metal on wood purlins.	0	100	Fire and blast	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Not known	0	100	Fire and blast	
Windows: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Completely destroyed.

DAMAGE ANALYSIS

Dimensions: 58 by 22 feet, 70 by 20 feet.
Ground floor area: 2,700 square feet.
Total area: 2,700 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10 feet.

Group 37.
Building Nos. 5 and 6.
Occupancy: Not known.
Building type: 1-story wood frame (D).
Fire classification: C.
Ground zero: 5,800 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile	0	100	Blast	
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Wood	0	100	Blast	
Interior walls: Wood (if any)	0	100	do	
Windows: Wood sash	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Completely destroyed by blast; no fire.

DAMAGE ANALYSIS

Dimensions: 110 by 60 feet.
Ground floor area: 6,600 square feet.
Total area: 6,600 square feet.
Number of floors: 1.
Eave height: Not known.
Mean elevation: 10 feet.

Group 37.
Building No. 7.
Occupancy: Not known.
Building type: Probably wood-framed shed (D).
Fire classification: C.
Ground zero: 5,900 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Not known	0	100	Fire and blast	
Trusses: Not known	100	0	do	
Columns: Not known	100	0	do	
First floor: Concrete	0	0		
Foundation: Concrete	0	0		
Exterior walls: Not known	0	100	Fire and blast	
Interior walls: Not known	0	100	do	
Windows: Not known	0	100	do	
Finish: Not known	0	100	do	
Contents: Not known	0	100	do	

Remarks: Completely destroyed and mostly cleared.

24. Inasi School, Group 38

a. This group consisted of four principal buildings plus two small wood-frame buildings which were used for school purposes. The group was located 6,400 feet southwest of GZ. It had a total plan area of approximately 30,347 square feet and contained a total floor area of approximately 68,047 square feet.

b. Building 1 was a light steel-frame structure, used as an auditorium, which received superficial and structural blast damage.

c. Buildings 2 and 3 were of reinforced-concrete type, and received superficial blast damage to

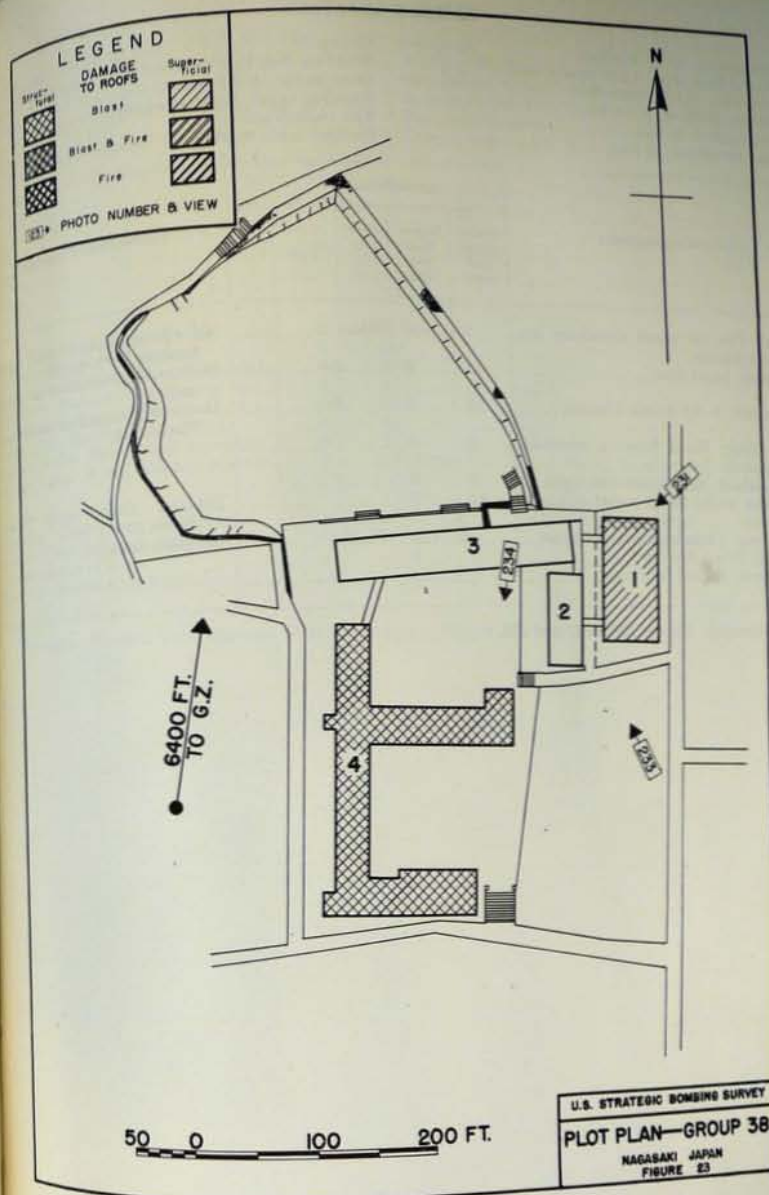
interior wood framing, walls, and ceilings. All of the glass was broken.

d. Building 4 was wood frame and was demolished by blast.

e. The two small wood buildings, which were of the shed type, were demolished by blast.

f. There was no fire damage to the buildings or to the contents.

g. Further information regarding this group is given on the damage analysis sheets following the plot plan on Figure 23, and Photos 230, 231, and 234.



24. Inasi School, Group 38

a. This group consisted of four principal buildings plus two small wood-frame buildings which were used for school purposes. The group was located 6,400 feet southwest of GZ. It had a total plan area of approximately 30,347 square feet and contained a total floor area of approximately 68,047 square feet.

b. Building 1 was a light steel-frame structure, used as an auditorium, which received superficial and structural blast damage.

c. Buildings 2 and 3 were of reinforced-concrete type, and received superficial blast damage to

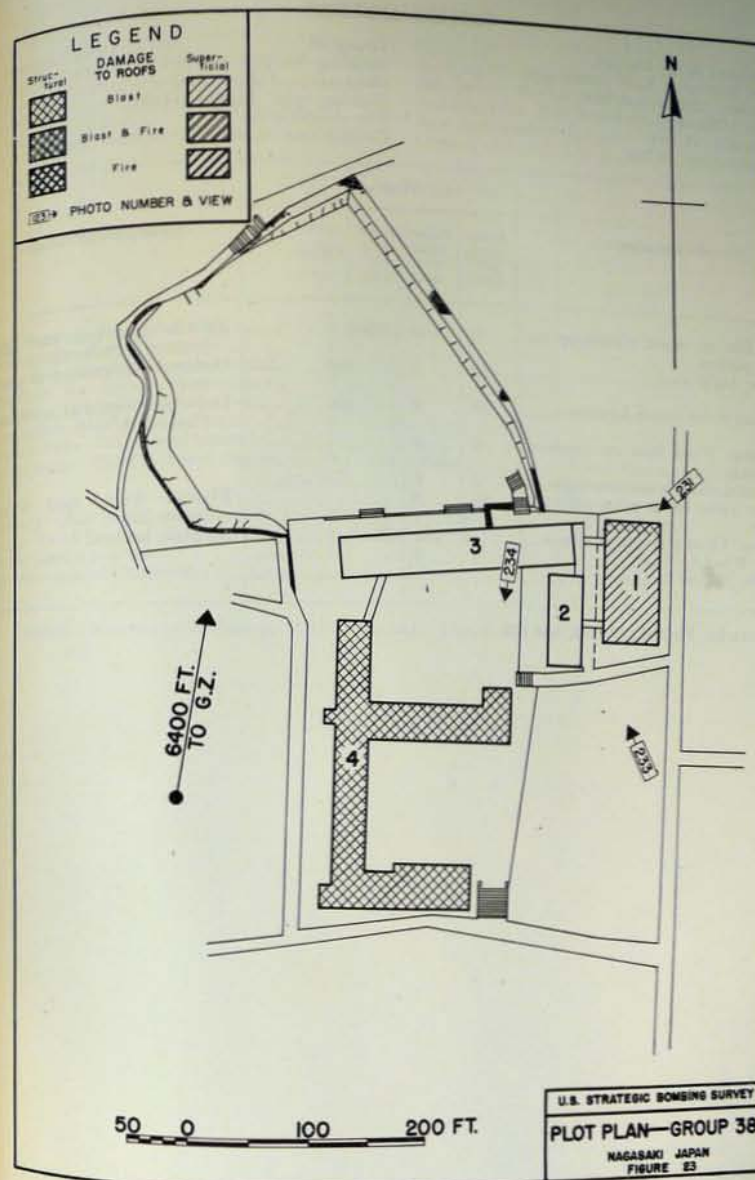
interior wood framing, walls, and ceilings. of the glass was broken.

d. Building 4 was wood frame and was demolished by blast.

e. The two small wood buildings, which were of the shed type, were demolished by blast.

f. There was no fire damage to the buildings or to the contents.

g. Further information regarding this group is given on the damage analysis sheets following the plot plan on Figure 23, and Photos 230, 231, and 234.



DAMAGE ANALYSIS

Dimensions: 52 by 104 feet.
Ground floor area: 5,408 square feet.
Total area: 5,408 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 95 feet.

Group 38.
Building No. 1.
Occupancy: Auditorium.
Building type: Light steel (D).
Fire classification: C.
Ground zero: 6,300 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Tile on wood sheathing on steel purlins.	0	100	Blast	All tile disturbed; roof lights broken. Photo 230.
Trusses: Light steel	10	0	do	Deflected downward at north end.
Columns: 8- by 4-inch I-beams	10	0	do	Deflected inward at north end. Photo 231.
First floor: Wood floor on concrete on earth.	0	0		
Foundation: 8-inch concrete walls	0	0		Blasted from steel frame. Photo 231.
Exterior walls: Sheet metal on steel frame.	80	0		All glass broken.
Windows: Clear glass, steel frames		100	Blast	
Finish: Wood flooring	0	0		
Contents: School furniture				

Remarks: Photos 230, 231, and 233.

DAMAGE ANALYSIS

Dimensions: 33 by 75 feet.
Ground floor area: 2,475 square feet.
Total area: 7,415 square feet.
Number of floors: 2 plus basement.
Eave height: 32 feet.
Mean elevation: 95 feet.

Group 38.
Building No. 2.
Occupancy: School.
Building type: Reinforced concrete (Ex1).
Fire classification: R.
Ground zero: 6,300 ft.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Basement: Concrete floor on earth	0	0		
Foundation: Reinforced concrete	0	0		
Exterior walls: Reinforced concrete	0	0		
Interior walls: Wood lath and plaster	0	75	Blast	Wood framing deflected away from blast coming through windows.
Windows: Clear glass, metal frames	0	100	do	All glass broken.
Finish: Wood flooring, plaster walls, hung plaster ceilings.	0	50	do	Hung ceilings fallen.
Contents: School furniture				

Remarks: No structural damage to this building. Photos 230 and 233.

DAMAGE ANALYSIS

Dimensions: 33 by 208 feet.
Ground floor area: 6,864 square feet.
Total area: 24,024 square feet.
Number of floors: 3 plus part basement.
Eave height: 44 feet.
Mean elevation: 95 feet.

Group 38.
Building No. 3.
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 6,300 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab.....	0	0		
Columns: Reinforced concrete.....	0	0		
Third floor: Reinforced-concrete slab.....	0	0		
Second floor: Reinforced-concrete slab.....	0	0		
First floor: Reinforced-concrete slab.....	0	0		
at eastern half; concrete on earth, western half.	0	0		
Basement: Concrete floor on earth.....	0	0		
Foundation: Reinforced concrete.....	0	0		
Exterior walls: Reinforced concrete.....	0	75	Blast	Wood framing deflected away from blast entering through windows.
Interior walls: Wood lath and plaster.....				All glass broken.
Windows: Clear glass, metal frames.....	0	100	do	Hung ceilings fallen. Photo 232.
Finish: Wood flooring, plaster walls, hung plaster ceilings.	0	50	do	
Contents: School furniture.....				

Remarks: No structural damage in this building. Photos 230, 232, and 233.

DAMAGE ANALYSIS

Dimensions: 175 by 200 feet over all.
Ground floor area: 15,600 square feet.
Total area: 31,200 square feet.
Number of floors: 2.
Eave height: Approximately 24 feet.
Mean elevation: 95 feet.

Group 38.
Building No. 4.
Occupancy: School.
Building type: Wood frame.
Fire classification: C.
Ground zero: 6,400 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing.....	0	100	Blast	Photo 234.
Trusses: Light wood.....	100	0	do	
Second floor: Wood flooring, wood joist.....	100	0	do	
First floor: Wood flooring, wood joist.....	90	0	do	
Foundation: Reinforced concrete.....	90	0	do	
Exterior walls: Wood siding on wood frame.....	0	100	do	
Interior walls: Wood.....	0	100	do	
Windows: Clear glass, wood frame.....	0	100	do	
Contents: School furniture.....	0	100	do	

Remarks: Building completely demolished by blast; no fire. Photo 234.

25. Nishizaka School, Group 42

a. This group consisted of four buildings which were used for school purposes. They were situated on the slope of a hill 6,500 feet to 6,800 feet southeast of GZ. The total plan area was approximately 20,460 square feet, and the total floor area was about 34,320 square feet. The buildings were of wood-frame construction.

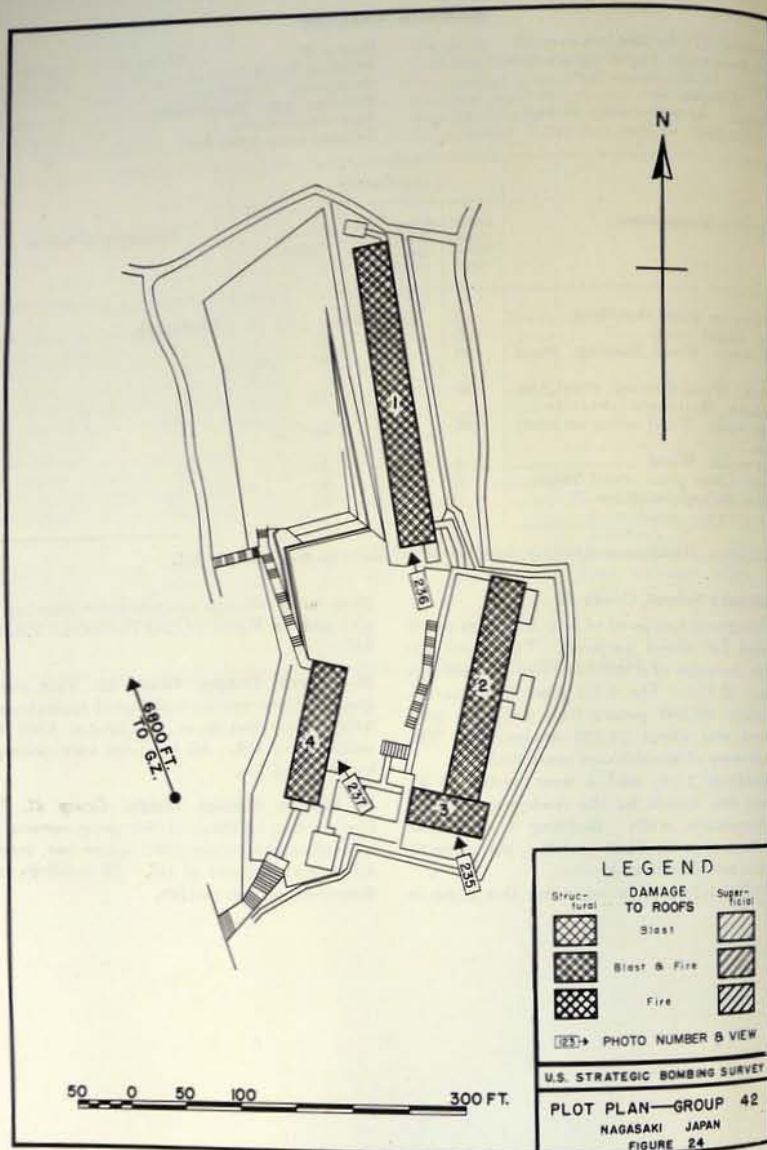
b. Buildings 1, 2, and 3 were destroyed by blast and fire, except for the steel-joist and concrete foundation walls. Building 4 was completely destroyed by blast and fire, the cause of which was not determined.

c. Further information regarding this group is

given on the damage analysis sheets following the plot plan on Figure 24, and Photos 235, 236, and 237.

26. Honren Temple, Group 46. This was a group of three wooden buildings of approximately 8,000 square feet in an area located 8,000 feet southeast of GZ. All buildings were destroyed by blast and fire.

27. Kokuho Fukusoi Temple, Group 47. The five wooden buildings of this group covered an area of approximately 9,000 square feet, located 8,200 feet southeast of GZ. All buildings were destroyed by blast and fire.



DAMAGE ANALYSIS

Dimensions: 30 by 264 feet.
Ground floor area: 7,920 square feet.
Total area: 15,840 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 100 feet.

Group 42.
Building No. 1.
Occupancy: Classrooms.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 6,500 feet.

Construction	Damage			Description of damage
	Struc- tural (per- cent)	Super- ficial (per- cent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	Wood consumed by fire; steel floor girders distorted. Photo 236.
Trusses: Light wood	100	0	do.	
Second floor: Wood floor on wood joist	100	0	do.	
First floor: Wood floor on steel, 6- by 12-inch I-girders.	100	0	do.	
Foundation: Concrete walls	90	0	do.	
Exterior walls: Wood siding on wood frame.	100	0	do.	
Interior walls: Not known.				
Windows: Plain glass, wood frames	0	100	do.	
Finish: Not known	0	100		
Contents: School furniture	0	100		

Remarks: Building completely destroyed by blast and fire except steel joist and concrete foundation walls. Photo 236.

DAMAGE ANALYSIS

Dimensions: 30 by 198 feet.
Ground floor area: 5,940 square feet.
Total area: 11,880 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 110 feet.

Group 42.
Building No. 2.
Occupancy: Classroom.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 6,800 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Tile on wood sheathing	0	100	Blast and fire	Only steel floor joists remain. Photo 235.
Trusses: Light wood	100	0		
Second floor: Wood floor on wood joist	100	0		
First floor: Wood floor on steel 6- by 12-inch I-girders	0	100		
Foundation: Concrete walls	75	0		
Exterior walls: Wood siding on wood frame	100	0		
Interior walls: Not known	0	100		
Windows: Plain glass, wood frames	0	100		
Finish: Not known	0	100		
Contents: School furniture	0	100		

Remarks: Building completely destroyed by blast and fire except steel joist and concrete foundation.
Photo 235.

DAMAGE ANALYSIS

Dimensions: 30 by 80 feet.
Ground floor area: 2,400 square feet.
Total area: 2,400 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 110 feet.

Group 42.
Building No. 3.
Occupancy: Classrooms.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 6,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile roof on wood sheathing	0	100	Blast and fire	Only steel floor joists remain. Photo 235.
Trusses: Light wood	100	0	do.	
First floor: Wood floor on steel 6- by 12-inch I-girders	100	0	do.	
Foundation: Brick walls	90	0	do.	
Exterior walls: Wood siding on wood frame	100	0	do.	
Windows: Plain glass, wood frames	0	100	Blast and fire	
Finish: Not known	0	100	do.	
Contents: Not known	0	100		

Remarks: Building completely destroyed by blast and fire except steel floor joist. Photo 235.

DAMAGE ANALYSIS

Dimensions: 30 by 140 feet.
Ground floor area: 4,200 square feet.
Total area: 4,200 square feet.
Number of floors: 1.
Eave height: 14 feet.
Mean elevation: 100 feet.

Group 42.
Building No. 4.
Occupancy: Classroom.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 6,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood sheathing	0	100	Blast and fire	Photo 237.
Trusses: Light wood	100	0	do.	
First floor: Wood on wood joist	100	0	do.	
Foundation: Stone wall	50	0		
Exterior walls: Wood siding, wood frame	100	0		
Windows: Plain glass, wood frame		100		
Finish: Not known	0	100		
Contents: Not known	0	100		

Remarks: Building completely destroyed by blast and fire. Photo 237.

28. Asahi School, Group 48

a. This group of five buildings was situated approximately 8,300 feet south of GZ. It consisted of one three-story, reinforced-concrete building (Building 5), three two-story, wood-frame buildings (Buildings 2, 3, and 4) and one one-story building (Building 1). The total plan area was approximately 20,600 square feet. The area of each building and its type are given below:

Building classification, Group 48

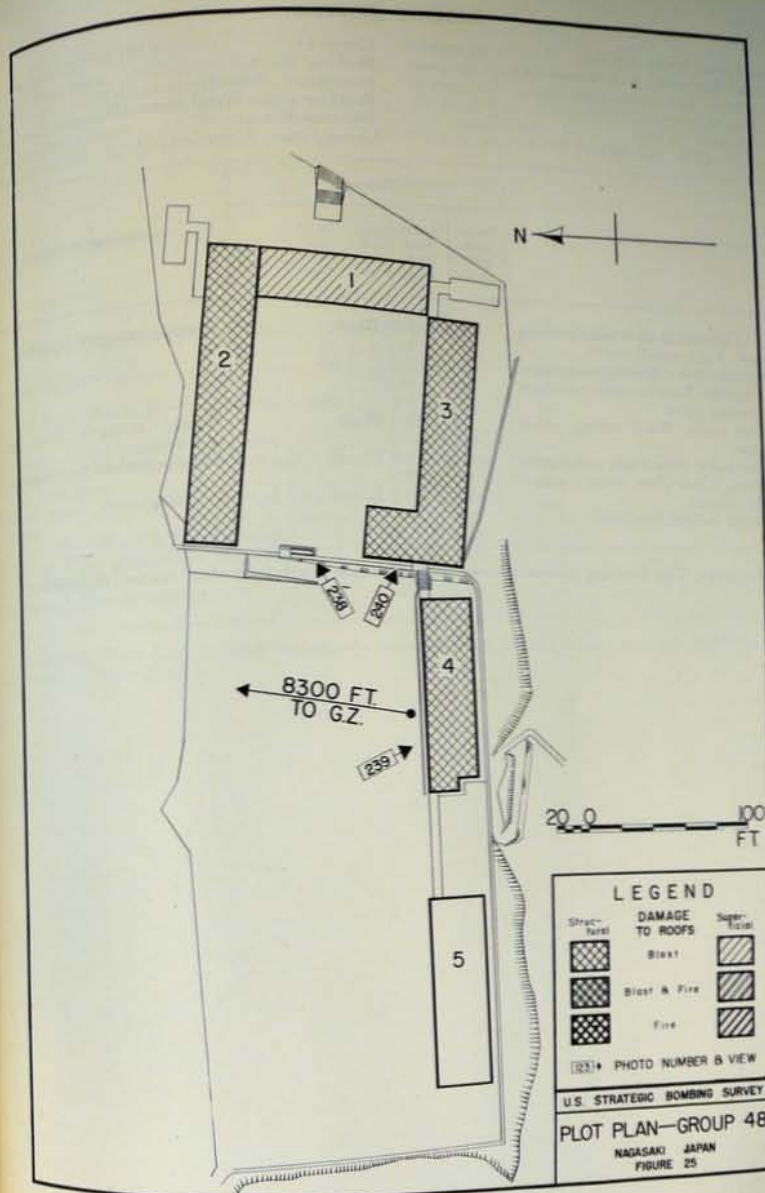
Building No.	Area		Type	Fire class	Construction	
	Plan	Total floor			Reinforced concrete	Wood
1.....	3, 131	3, 131	D	C	---	X
2.....	5, 863	11, 726	E2	C	---	X
3.....	5, 332	10, 664	E2	C	---	X
4.....	2, 821	5, 642	E2	C	---	X
5.....	3, 465	10, 395	E1	N	X	---
Total.....	20, 612	41, 558			1	4

b. The reinforced-concrete structure (Building 5) sustained only minor damage to glass and interior partitions.

c. The wood framed buildings were all damaged to varying degrees by the atomic bomb. Building 1, a one-story structure, was shielded by the two-story structure (Building 2) and sustained only superficial damage to the roof.

d. A high-explosive bomb, dropped 1 August 1945, scored a direct hit on building 4, partly destroying it. Additional structural damage was done by the atomic bomb.

e. No fire occurred in any structure in this group.



DAMAGE ANALYSIS

Dimensions: 31 by 101 feet.
Ground floor area: 3,131 square feet.
Total area: 3,131 square feet.
Number of floors: 1.
Eave height: 12 feet.
Mean elevation: 130 feet.

Group 48.
Building No. 1.
Occupancy: School.
Building type: Wood frame (D).
Fire classification: C.
Ground zero: 8,300 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile roofing on wood sheathing.	0	100	Blast	Roofing stripped by blast.
Trusses: Light wood.	0	0		
First floor: Wood flooring, wood joist.	0	0		
Foundation: Reinforced-concrete walls and piers.	0	0		
Exterior walls: Wood siding, wood frame.	0	10	Blast	Siding stripped from wood frame.
Interior walls: Wood lath and plaster.	0	10	Blast	Plaster broken and cracked.
Windows: Clear glass, wood frame.	0	100		
Finish: Plaster.	0	50	Blast	do.
Contents: School furniture.	0	0		

Remarks: This building protected from blast of atomic bomb by 2-story section of Building 2.

DAMAGE ANALYSIS

Dimensions: 31 by 173 feet.
Ground floor area: 5,863 square feet.
Total area: 11,726 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 130 feet.

Group 48.
Building No. 2.
Occupancy: School.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 8,300 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile roofing on wood sheathing.	0	100	Blast	Completely destroyed by blast. Photo 238.
Trusses: Light wood.	100	0	do.	Completely demolished by blast. Photo 238.
Second floor: Wood flooring, wood joist.	100	0	do.	
First floor: Wood flooring, wood joist.	75	0	do.	
Foundation: Reinforced-concrete walls and piers.	0	0	do.	
Exterior walls: Wood siding on wood frame.	100		do.	
Interior walls: Wood lath and plaster.	0	100	do.	
Windows: Clear glass, wood frames.	0	100	do.	
Finish: Plaster.	0	100	do.	
Contents: School furniture.	0	75	do.	

Remarks: West $\frac{1}{2}$ of building completely demolished by atomic bomb; east $\frac{1}{2}$ of Building nearly demolished. Photo 238.

DAMAGE ANALYSIS

Dimensions: 60 by 140 feet over all.
Ground floor area: 5,332 square feet.
Total area: 10,664 square feet.
Number of floors: 2.
Eave height: 25 feet.
Mean elevation: 130 feet.

Group 48.
Building No. 3.
Occupancy: School.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 8,300 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile roofing on wood sheathing.	0	100	Blast	See remarks.
Trusses: Light wood.	100	0		
Second floor: Wood flooring on wood joist.	75	0	Blast	
First floor: Wood flooring on wood joist.	0	0		
Foundation: Concrete walls and piers.	50	0	Blast	
Exterior walls: Wood siding on wood frame.	75		do.	
Interior walls: Wood lath and plaster.	0	75	do.	
Windows: Clear glass, wood frames.	0	100	do.	
Finish: Plaster.	0	75	do.	
Contents: School furniture.	0	50	do.	

Remarks: Building partly destroyed by direct hit of high explosive bomb on 1 Aug. 1945. Photo 240.

DAMAGE ANALYSIS

Dimensions: 31 by 97 feet.
Ground floor area: 2,821 square feet.
Total area: 5,642 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 130 feet.

Group 48.
Building No. 4.
Occupancy: School.
Building type: Wood frame (E2).
Fire classification: C.
Ground zero: 8,300 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing.	0	75	Blast	
Trusses: Light wood.	0	75	do.	
Second floor: Wood flooring on wood joist.	0	0		
First floor: Wood flooring on wood joist.	0	0		
Foundation: Concrete walls and piers.				
Exterior walls: Wood siding on wood frame.	75	0	Blast	
Interior walls: Wood lath and plaster.	0	75	do.	
Windows: Clear glass, wood frames.	0	100	do.	
Finish: Wood trim and plaster.	0	75	do.	
Contents: School furniture.	0	0		

Remarks: North wall deflected inward. Photo 239.

DAMAGE ANALYSIS

Dimensions: 33 by 105 feet.
Ground floor area: 3,465 square feet.
Total area: 10,395 square feet.
Number of floors: 3.
Eave height: 42 feet.
Mean elevation: 130 feet.

Group 48.
Building No. 5.
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: N.
Ground zero: 8,300 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced-concrete slab	0	0		
Third floor: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Foundation: Reinforced concrete	0	0		
Exterior walls: Reinforced concrete	0	50	Blast	Plaster cracked and broken.
Interior walls: Wood lath and plaster	0	100	do	All glass broken, approximately 25 percent frames bent.
Windows: Clear glass, steel frames	0	100	do	Plaster fallen, ceilings fallen.
Finish: Wooden flooring, plaster walls, hung ceilings	0	50		
Contents: School furniture	0	0		

Remarks: No structural damage in this building.

29. Nakamachi Church, Group 70

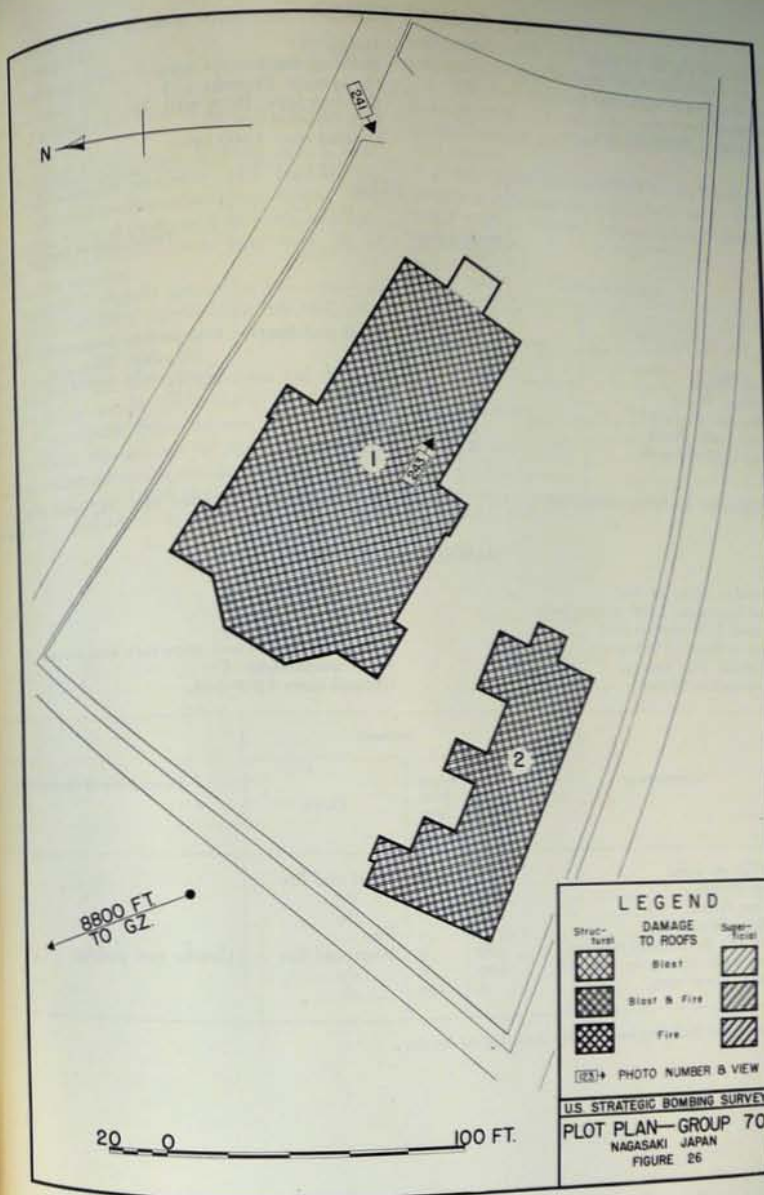
a. This group of two buildings was situated approximately 8,800 feet southeast of GZ. One of the buildings was a church and the other a rectory, the two having a plan area of approximately 10,800 square feet.

b. The church wall sustained little or no damage from blast. The entire structure, however, was badly damaged by fire; the roof and supports were burned away completely as was the wood flooring

which was laid on concrete piers. All of the combustible material was consumed by fire.

c. The rectory, constructed of wood and stone on lath with a tile on wood roof, was completely destroyed by fire. The foundation of concrete showed many cracks and considerable spalling of the outer surfaces.

d. Further details in connection with this group will be found in Figure 26, in the following damage analysis sheets, and in Photos 241 to 243.



DAMAGE ANALYSIS

Dimensions: 150 by 55 feet.
Ground floor area: 8,250 square feet.
Total area: 8,250 square feet.
Number of floors: 1.
Eave height: 20 and 35 feet.

Group 70.
Building No. 1.
Occupancy: Church.
Building type: Brick wall (D).
Fire classification: C.
Ground zero: 8,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	Completely destroyed. Photos 241, 242, 243.
Trusses: Wood	100	0	do	Completely destroyed.
First floor: Wood	0	100	do	Do.
Foundation: Stone	5	0	Fire	
Exterior walls: Brick	0	95	do	
Windows: Metal sash				

Remarks: Building completely gutted. Walls in good condition. Photos 241, 242, and 243.

DAMAGE ANALYSIS

Dimensions: 75 by 35 feet.
Ground floor area: 2,600 square feet.
Total area: 2,600 square feet.
Number of floors: Not known.
Eave height: Not known.
Mean elevation: 30 feet.

Group 70.
Building No. 2.
Occupancy: Rectory.
Building type: Wood, wire lath and stucco (D).
Fire classification: C.
Ground zero: 8,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile on wood	0	100	Blast and fire	Cracks and scaling.
Trusses: Wood	100	0	do	
Columns: Wood	100	0	do	
First floor: Wood	100	0	Fire	
Foundation: Reinforced concrete	100	0	Blast and fire	
Exterior walls: Stucco on wire lath	100	0	do	
Windows: Wood sash	0	100	do	

Remarks: Building completely demolished by fire.

30. Funatsu Machi Branch, Mitsubishi Hospital, Group 72

This group was located approximately 9,300 feet southeast of GZ. The two principal buildings had a total plan area of approximately 5,800 square feet.

Building 1, the main building, was a two-story-and-basement structure with load-bearing brick walls and reinforced-concrete floors. The roof trusses were of steel; roof covering, top floor ceiling, doors, windows and trim were all of combustible material.

Building 2, slightly smaller in plan area, was composed of entirely combustible material, and, in the absence of evidence, is assumed to have been a single-story structure.

Although not far enough from GZ to have escaped minor injury from blast, the buildings suffered principally from intense fire. Building 1 was completely gutted by fire, but its walls (only 8 inches thick) did not collapse.

The entire roof and the interior of the hospital were destroyed by fire and blast. The

auxiliary building was totally destroyed by fire and blast. All other buildings were entirely consumed except for their foundations.

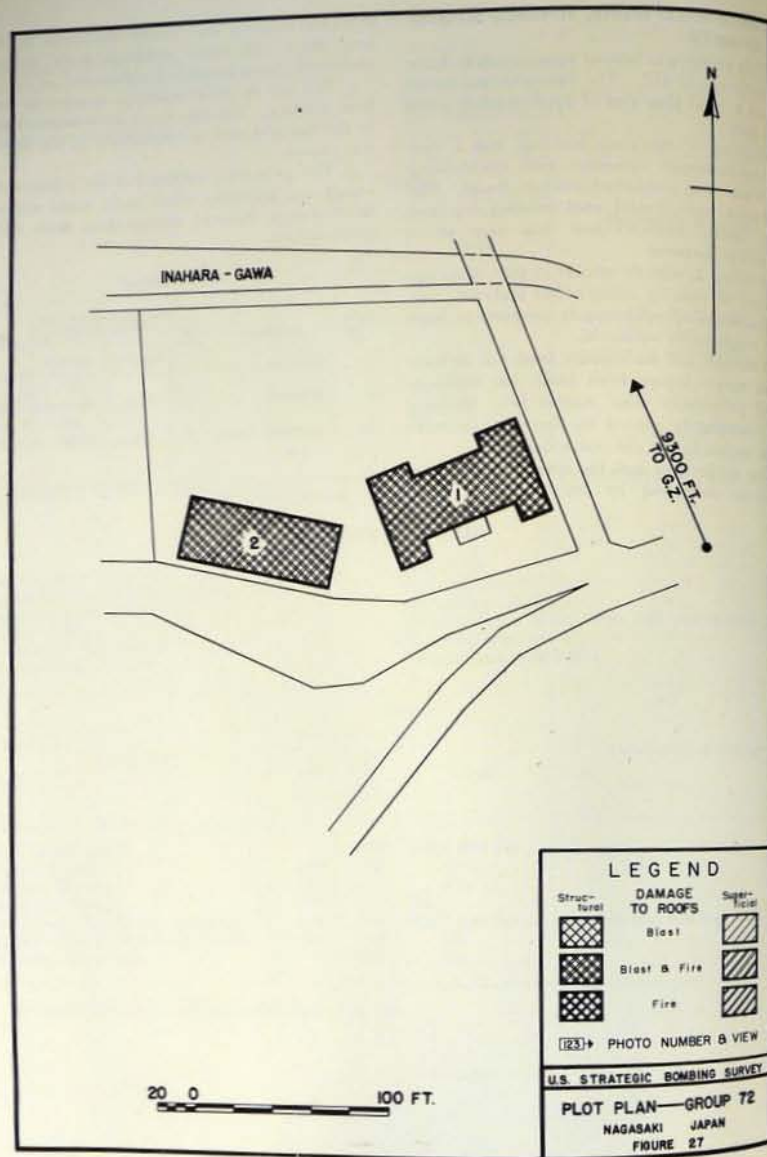
f. The fire in these buildings appears to have been primary. No open flame devices were noted in the hospital and the possibility of fire spread was remote.

g. Fire protection consisted of the public water supply and hydrants, small static tanks and one hand pump. Several extinguishers were noted in the debris.

Table of damage

Building No.	Occupancy	Fire class	Estimated damage, blast and fire, buildings		Fire contents
			Superficial	Structural	
1.	Hospital	(?)	Total	Moderate	Total
2.	Auxiliary building	C	do	Total	Do.

¹ Roof C, balance R.



DAMAGE ANALYSIS

Dimensions: 80 by 48 feet over all.
Ground floor area: 3,200 square feet.
Total area: 9,600 square feet.
Number of floors: 2 and basement.
Rave height: 38 feet.
Mean elevation: 20 feet.

Group 72.
Building No. 1.
Occupancy: Hospital.
Building type: 2-story, wall-bearing (F2).
Fire classification: Mixed (C roof, remainder R).
Ground zero: 9,300 feet.

Construction	Damage		Cause	Description of damage
	Struc- tural (per- cent)	Super- ficial (per- cent)		
Roof: Asbestos shingles on wood sheathing and purlins.	0	100	Fire and blast	Completely gone.
Trusses: Steel	100	0	do	Still in place but warped.
Second floor: Reinforced-concrete slab.	10	0	Fire and debris	Finish coat broken.
First floor: Reinforced-concrete slab.	10	0	do	do.
Basement: Reinforced-concrete slab on earth.	0	10	do	do.
Foundation: 12-inch brick, stuccoed, up to first floor line.	0	10	Fire	Finish damaged.
Exterior walls: 8-inch brick load-bearing, with 4-inch pilasters at intervals.	0	10	do	Minor surface cracks.
Interior walls: 8-inch brick load-bearing (some 4-inch brick partitions on second floor).	0	10	do	do.
Windows: Wood sash, double-hung	0	100	Fire and blast	Completely gone.
Finish: Plaster, wood trim	0	100	Fire	Plaster ruined, wood consumed.
Contents: Hospital furniture	0	100	do	Consumed by fire.

Remarks: Blast was secondary cause of damage.

DAMAGE ANALYSIS

Dimensions: 80 by 32 feet.
Ground floor area: 2,560 square feet.
Total area: 2,560 square feet (probably).
Number of floors: 1 (probably).
Eave height: Not known.
Mean elevation: 20 feet.

Group 72.
Building No. 2.
Occupancy: Hospital or dependency.
Building type: Wood-framed (D).
Fire classification: C.
Ground zero: 9,300 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Clay tile in mud on wood sheathing, rafters, purlins.	0	100	Fire and blast	Completely demolished.
Trusses: Wood	100	0	do.	do.
Columns: Wood	100	0	do.	do.
Second floor: Probably none	0	0	Fire and blast	do.
First floor: Wood	100	0	do.	do.
Foundation: Reinforced concrete	0	0	Fire and blast	do.
Exterior walls: Wood	100	0	do.	do.
Interior walls: Wood	0	100	do.	do.
Windows: Probably wood sash	0	100	do.	do.
Finish: Probably plaster and wood	0	100	do.	do.
Contents: Not known	0	100	Fire	do.

Remarks: Completely consumed except foundation walls. Blast effect probably unimportant.

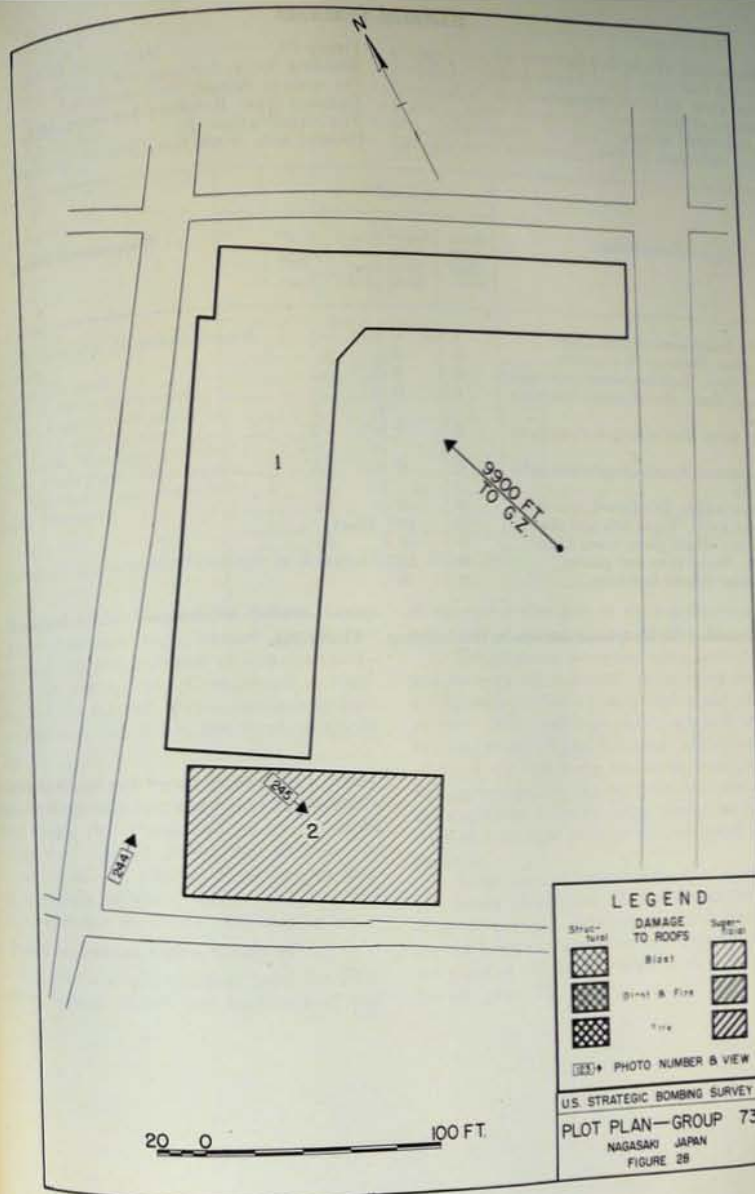
31. Shinkoozen School, Group 73

a. This group of buildings was situated approximately 9,800 feet southeast of GZ. There were two buildings covering a total plan area of 18,900 square feet.

b. Building 1, a reinforced-concrete structure, three stories high, suffered only superficial damage, such as broken glass and displacement of interior wood partitions.

c. Building 2 was a one-story structure with reinforced-concrete walls and light-steel trusses with wooden roof. The only damage to this building was broken window glass and displaced roofing.

d. Further details in connection with this group will be found on Figure 28 and the following damage-analysis sheets, and also in Photos 244 and 245.



DAMAGE ANALYSIS

Dimensions: 175 by 210 feet over all.
Ground floor area: 14,375 square feet.
Total area: 43,125 square feet.
Number of floors: 3.
Eave height: 40 feet.
Mean elevation: 20 feet.

Group 73.
Building No. 1.
Occupancy: School.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 9,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Reinforced-concrete slab	0	0		
Columns: Reinforced concrete	0	0		
Third floor: Reinforced-concrete slab	0	0		
Second floor: Reinforced-concrete slab	0	0		
First floor: Reinforced-concrete slab	0	0		
Foundation: Reinforced-concrete walls	0	0		
Exterior walls: Reinforced concrete	0	0	Blast	
Interior walls: Wood lath and plaster	0	10	do	
Windows: Plain glass, wood frame	0	40	do	
Finish: Wood trim and plaster	0	20	do	
Contents: School furniture	0	0		

Remarks: No structural damage in this building. Photo 244.

DAMAGE ANALYSIS

Dimensions: 48 by 96 feet.
Ground floor area: 4,608 square feet.
Total area: 4,608 square feet.
Number of floors: 1.
Eave height: 20 feet.
Mean elevation: 20 feet.

Group 73.
Building No. 2.
Occupancy: Auditorium.
Building type: Steel and concrete (D).
Fire classification: N (roof) R (walls).
Ground zero: 9,800 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Composition shingles on wood sheathing	0	100	Blast	Photo 245.
Tusses: Light steel	0	0		Do.
Columns: Reinforced concrete	0	0		
First floor: Concrete on earth	0	0		
Foundation: Concrete piers	0	0		
Exterior walls: Reinforced concrete	0	0		
Windows: Plain glass, steel frames	0	100		All glass broken.
Finish: Fiber board and wood trim	0	10		
Contents: Furniture	0	0		

Remarks: No structural damage in this building. Photo 245.

22. Municipal Girls' Commercial School, Group 78

These buildings were located 10,200 feet southeast of GZ, and occupied an area of approximately 8,000 square feet. Constructed of wood, plaster, and tile, they offered no resistance to blast or fire and were completely destroyed, primarily by fire.

23. District Court and Public Prosecutor's Office, Group 78; Regional Court and Public Prosecutor's Office, Group 79. These two groups of eight buildings were located 10,800 feet southeast of GZ, and covered an area of 22,000 square feet. They were built of wood, plaster, and tile, and all were completely destroyed, primarily by fire.

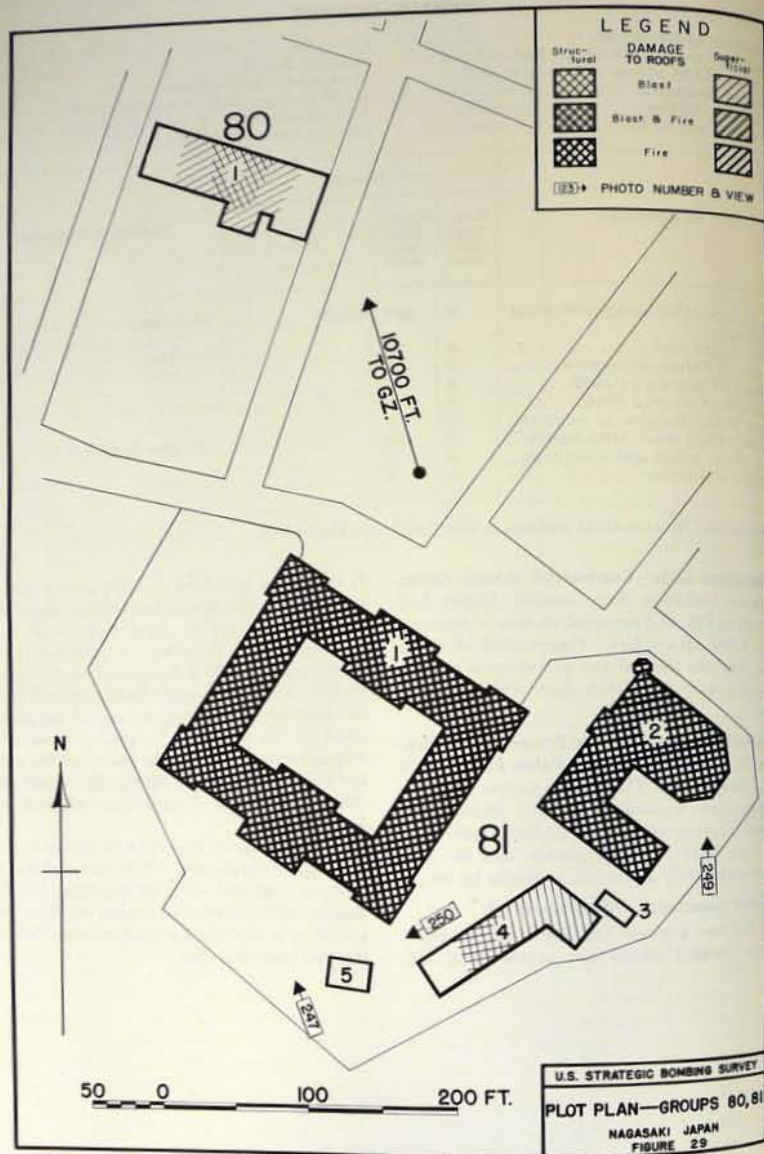
24. Relief Association Office, Group 80

a. This was a single building, used for office purposes, located 10,500 feet southeast of GZ.

It covered a plan area of 5,522 square feet and contained 16,566 square feet of floor area.

b. The structure as native style, wood frame, and three stories in height. It extended through a congested city block and opened on two parallel streets. Other buildings closely adjoined on the two long sides. Probably because of the shielding effect of the adjoining structures, most of the damage occurred on the top story, but some damage was caused below by falling plaster and debris. Over-all structural damage was estimated at 15 percent.

c. At the time of inspection the third story had been nearly all removed. Reference was therefore made to post-raid aerial photography (dated 30 August 1945) to arrive at damage estimates which are given in the damage analysis sheet following the plot plan (Fig. 29).



DAMAGE ANALYSIS

Dimensions: 125 by 58 feet over all.
Ground floor area: 5,522 square feet.
Total area: 16,566 square feet.
Number of floors: 3.
Face height: 30 feet.
Mean elevation: 15 feet.

Group 80.
Building No. 1.
Occupancy: Relief association office.
Building type: 3-story wood frame (E2).
Fire classification: C.
Ground zero: 10,500 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Tile in mud on wood sheathing, rafters, purlins.	0	50	Blast	25 percent broken in; remainder of damage was displacement of tile.
Trusses: Wood.	25	0	do	Collapsed.
Columns: Wood.	5	0	do	On third floor only.
Third floor: Wood flooring and framing.	0	20	Debris	Flooring broken, framing undamaged.
Second floor: Wood flooring and framing.	0	15	do	do.
First floor: Wood flooring and framing.	0	10	do	do.
Foundation: Concrete.	0	0		
Exterior walls: East wall stucco on wood lath; remainder wood.	0	10	Blast	Upper parts cracked.
Interior walls: Wood frame.	0	10	do	On third floor only.
Windows: Wood sash.	0	100	do	Glass out.
Finish: Plaster, wood trim.	0	40	do	Cracked.
Contents: Not known.	0	0		

Remarks: Third story had been mostly dismantled when inspected; aerial photography of 30 August used to supplement observations in estimating damage.

35. Nagasaki Prefectural Office and Courthouse, Group 81

a. This group, located in the central part of the city, included five buildings as shown in Figure 29, covering a plan area of 3,400 square feet and containing a floor area of 89,000 square feet. The center of the group was approximately 10,900 feet south by east from GZ.

b. The two main buildings (Buildings 1 and 2), covered 87 percent of the plan area of the group and contained 91 percent of the total floor area. They were similarly constructed with brick load-bearing walls, unprotected steel roof trusses, and combustible secondary roof framing and upper floors. Both were used principally for administrative offices, although Building 1 also contained storage space, a kitchen, and a laboratory. Building 2 also had a laboratory. The interior and

contents of both buildings were destroyed by fire which also distorted most of the steel roof trusses. The buildings were 90 percent structurally damaged and 10 percent superficially damaged by fire.

c. Two small buildings (3 and 5), having load-bearing walls and combustible interiors and roofs, sustained only minor damage. A garage (Building 4) of two-story, wood-frame construction which suffered considerable damage from blast was being dismantled at the time of inspection so that the extent of damage was not well defined.

d. Damage to the group as a whole was estimated at 83 percent structural, 11 percent superficial, and 1 percent minor, or a total of 95 percent.

e. A statement regarding the cause of fire in Building 1 was obtained from Sasaguchi, fire warden of this building, who was present at the time of the attack. He said that the fire began in

the second-floor ceiling on the south side of the central portion of the building. Ignition was believed to have occurred about 10 minutes before the smoke was first seen. The cause was thought to have been the radiant heat from the bomb, conducted by a lightning rod to the second floor ceiling, since the heat was intense enough to cause the lightning rod to buckle. The witness claimed that there were no open-flame devices on the second floor and no flying embers were noted. Within 40 minutes the fire spread to all parts of the building and no attempt was made to extinguish it.

f. The informant could not offer any explanation for the probable cause of the fire in Building 2, but the fires in both buildings were thought to have been due to primary causes. He stated that he observed that fires in general started simultaneously in that part of the city, appearing to start in the roofs of buildings and to work downward.

g. Fire protection for the group consisted of the public hydrants and water supply. A static tank

was located in the street near by. A portable gasoline-driven pump was found in the yard, and fire extinguishers were observed in both of the main buildings.

h. The following table gives fire and blast damage to buildings and fire damage to contents.

Table of damage

Building No.	Occupancy	Fire class	Estimated damage, fire and blast, buildings		Fire loss, contents
			Superficial	Structural	
1.....	Office, laboratory, storage, kitchen.	C	Total	Serious	Serious
2.....	Offices, laboratory.	C	do	do	Total

i. Details of construction and damage will be found in Photos 246 through 250 and in the damage analysis sheets following this summary.

DAMAGE ANALYSIS

Dimensions: 188 by 180 feet over all.
Ground floor area: 21,254 square feet.
Total area: 63,762 square feet.
Number of floors: 2 and basement.
Eave height: 35 feet.
Mean elevation: 20 feet.

Group 81.
Building No. 1.
Occupancy: Prefectural offices.
Building type: 2-story wall-bearing (F2).
Fire classification: C.
Ground zero: 10,900 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Slate and sheet metal on wood sheathing and purlins.	0	100	Fire	Consumed.
Trusses: Steel	90	0	do	Warped and twisted.
Second floor: Wood flooring and framing on steel main beams.	100	0	do	Consumed; steel warped.
First floor: Reinforced-concrete slab.	0	10	Fire and debris	Surface cracks.
Basement: Concrete floor on earth.	0	0		
Foundation: Load-bearing brick, stuccoed.	10	0	Fire	Minor cracks, stucco peeling.
Exterior walls: Load-bearing brick, stuccoed.	10	0	do	do.
Interior walls: Load-bearing brick.	10	0	do	Minor cracks.
Windows: Wood, double-hung.	0	100	do	Consumed.
Finish: Plaster, wood trim.	0	100	do	Wood consumed, plaster cracked and peeling.
Contents: Office furniture	0	100	do	Consumed.

Remarks: Completely burned out. See Photos 246, 247, and 248.

DAMAGE ANALYSIS

Dimensions: 124 by 93 feet over all.
Ground floor area: 8,398 square feet.
Total area: 16,796 square feet.
Number of floors: 2.
Eave height: 35 feet.
Mean elevation: 20 feet.

Group 81.
Building No. 2.
Occupancy: Prefectural courthouse.
Building type: 2-story wall-bearing (F2).
Fire classification: C.
Ground zero: 10,900 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Slate on wood sheathing and purlins.	0	100	Fire	Consumed.
Trusses: Steel	50	0	do	Warped and twisted.
Second floor: Wood flooring and framing on steel main beams.	100	0	do	Consumed.
First floor: Concrete on earth in lobby, elsewhere wood.	90	0	do	do.
Foundation: Load-bearing brick walls and piers; stucco.	10	0	do	Minor cracks, stucco peeling.
Exterior walls: Load-bearing brick, stucco.	10	0	do	do.
Interior walls: Load-bearing brick.	10	0	do	Minor cracks.
Windows: Wood, double-hung.	0	100	do	Consumed.
Finish: Plaster, wood trim.	0	100	do	Wood consumed, plaster cracked and peeling.
Contents: Office furniture	0	100	do	Consumed.

Remarks: Completely burned out. Photos 246 and 249.

DAMAGE ANALYSIS

Dimensions: 28 by 13 feet.
Ground floor area: 364 square feet.
Total area: 364 square feet.
Number of floors: 1.
Eave height: 11 feet.
Mean elevation: 20 feet.

Group 81.
Building No. 3.
Occupancy: Toilets.
Building type: 1-story wall-bearing (D).
Fire classification: C.
Ground zero: 10,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Tile in mud on wood sheathing and framing.	0	0		
Trusses: Wood.	0	0		
First floor: Concrete on earth; ceramic tile finish.	0			
Foundation: Concrete.	0			
Exterior walls: 8-inch brick, stuccoed.	0			
Interior walls: Wood frame.	0	0		
Windows: Wood sash.	0	0		
Finish: Plaster, tile, wood trim.	0	0		
Contents: Plumbing fixtures.				

Remarks: Shielded from blast by Buildings 1 and 2.

DAMAGE ANALYSIS

Dimensions: 115 by 50 feet.
Ground floor area: 3,375 square feet.
Total area: 6,750 square feet.
Number of floors: 2.
Eave height: 22 feet.
Mean elevation: 20 feet.

Group 81.
Building No. 4.
Occupancy: Garage.
Building type: Wood frame, 2-story (E2).
Fire classification: C.
Ground zero: 10,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Asbestos shingles on wood sheathing, rafters, purlins.	0	75	Blast	Percentage uncertain; building being taken down when inspected.
Trusses: Wood roof trusses, steel flat trusses over wide doors.	25	0	do	do.
Columns: Steel under steel trusses otherwise wood.	50	0	do	do.
Second floor: Wood.	50	0	do	do.
First floor: Concrete on earth.	0	0		
Foundation: Concrete.	0	0		
Exterior walls: Wood.	0	50	Blast	do.
Interior walls: Wood.	0	30	do	do.
Windows: Wood sash.	0	100	do	do.
Finish: Plaster, wood trim.	0	90	do	Plaster cracked and fallen.
Contents: Not known.	0	0		

DAMAGE ANALYSIS

Dimensions: 30 by 20 feet.
Ground floor area: 600 square feet.
Total area: 1,200 square feet.
Number of floors: 2.
Eave height: 20 feet.
Mean elevation: 20 feet.

Group 81.
Building No. 5.
Occupancy: Record storage.
Building type: Vault (F2).
Fire classification: C.
Ground zero: 10,900 feet.

Construction	Damage			Description of damage
	Structural (percent)	Superficial (percent)	Cause	
Roof: Hipped; tile, probably in mud over wood framing.	0	0		Displaced tiles.
Trusses: Probably wood.	0	10	Blast	
Second floor: Light wood floor between book stacks.	0	0		
First floor: Concrete on earth.	0	0		
Foundation: Concrete.	0	0		
Exterior walls: Concrete (possibly brick or dozo, stuccoed).	0	0		
Windows: Bars and steel shutter, no glass.	0	0		Front door (metal) distorted inward by blast or heat.
Contents: Books.	0	0		

Remarks: Shielded by Building 1. Photo 250.

8. Main Post Office, Group 83

a. This group comprised three buildings, located at a distance of approximately 12,400 feet southeast of GZ. Total plan area was 20,860 square feet.

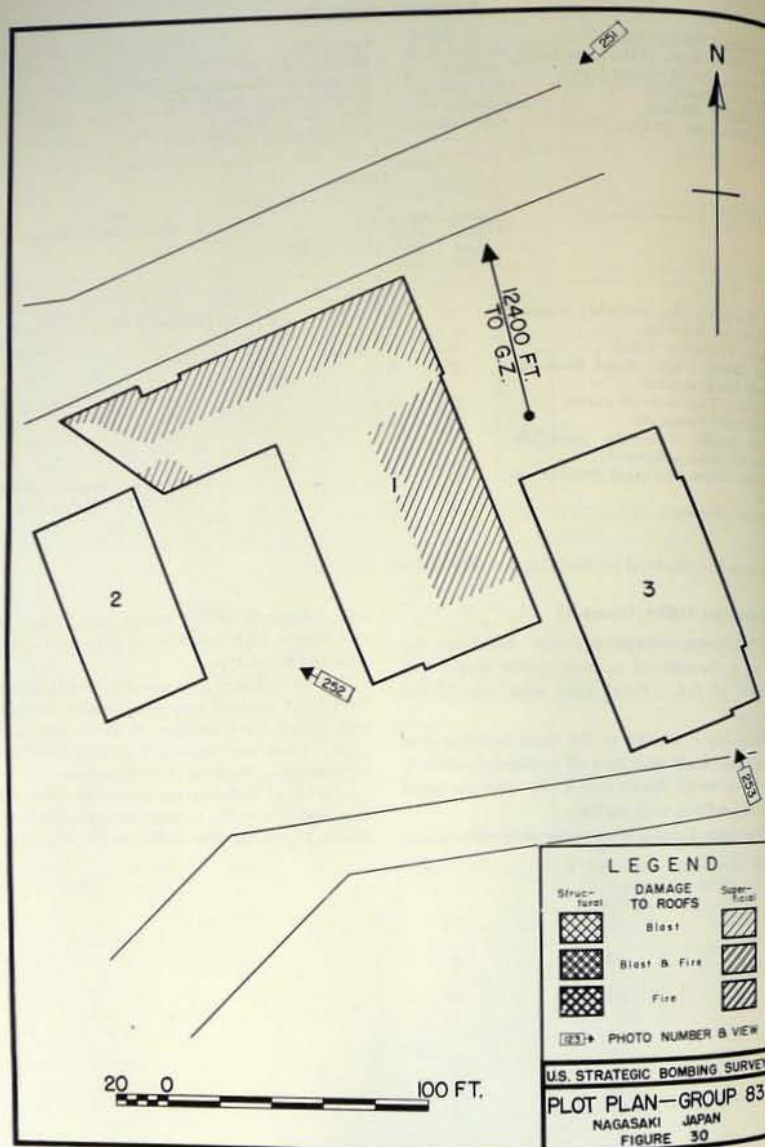
b. Building 1, known as the main building, was three stories high and was of reinforced-concrete frame with wood floors and a tile roof on wood sheathing, rafters, and purlins.

c. Buildings 2 and 3 housed the post-office annex

and telegraph office, respectively. They were two stories high and were of reinforced-concrete, slab-and-beam type.

d. The buildings were not structurally damaged. Building 1 received superficial damage to the roof and minor blast damage to floors and interior trim. Glass was broken. Buildings 2 and 3 were undamaged, excepting for broken glass.

e. Further information regarding these buildings appears on the damage analysis sheets which follow Figure 30; also in Photos 251, 252, and 253.



DAMAGE ANALYSIS

Dimensions: 141 by 139 feet over all.
Ground floor area: 11,580 square feet.
Total area: 34,740 square feet.
Number of floors: 3.
Floor height: 40 feet.
Mean elevation: 10 feet.

Group 83.
Building No. 1.
Occupancy: Post office.
Building type: 3-story, reinforced-concrete frame (E2).
Fire classification: C.
Ground zero: 12,400 feet.

Construction	Damage			Description of damage
	Structural (per-cent)	Superficial (per-cent)	Cause	
Roof: Tile on wood sheathing, rafters, purlins.	0	50	Blast	Tiles displaced and loosened.
Tusses: Wood	0	0		
Columns and beams: Reinforced concrete.	0	0		
Third floor: Wood	0	5	Debris	Damage from falling plaster.
Second floor: Wood	0	5	do	do.
First floor: Wood	0	5	do	do.
Foundation: Concrete	0	0		
Exterior walls: Concrete	0	0		
Interior walls: Wood frame	0	20	Blast	Cracked plaster.
Windows: Wood sash, double-hung	0	95	do	Glass broken.
Finish: Plaster, wood trim	0	20	do	Cracked and fallen plaster.
Contents: Office furniture, etc.	0	5	Debris	Damage from falling plaster.

Remarks: Photo 251.

DAMAGE ANALYSIS

Dimensions: 78 by 43 feet.
Ground floor area: 3,354 square feet.
Total area: 6,708 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 10 feet.

Group 83.
Building No. 2.
Occupancy: Post-office annex.
Building type: 2-story, reinforced-concrete frame (E1).
Fire classification: Fire resistant.
Ground zero: 12,400 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Built-up roofing on flat concrete slab.	0	0		
Columns and beams: Reinforced concrete.	0	0		
Second floor: Concrete slab on earth.	0	0		
First floor: Concrete slab on earth.	0	0		
Foundation: Concrete.	0	0		
Exterior walls: Concrete.	0	0		
Interior walls: 4-inch masonry.	0	0		
Windows: Steel sash, double-hung.	0	10	Blast	Broken glass.
Finish: Plaster, wood trim.	0	0		
Contents: Office furniture.	0	0		

Remarks: Excellent condition. Photo 252.

DAMAGE ANALYSIS

Dimensions: 109 by 55 feet over all.
Ground floor area: 5,926 square feet.
Total area: 11,852 square feet.
Number of floors: 2.
Eave height: 24 feet.
Mean elevation: 10 feet.

Group 83.
Building No. 3.
Occupancy: Telegraph office.
Building type: 2-story reinforced-concrete frame (E1).
Fire classification: Fire resistant.
Ground zero: 12,400 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Built-up roofing on flat concrete slab.	0	0		
Columns and beams: Reinforced concrete.	0	0		
Second floor: Concrete slab and beams.	0	0		
First floor: Concrete slab on earth.	0	0		
Foundation: Concrete.	0	0		
Exterior walls: Concrete.	0	0		
Interior walls: 4-inch masonry.	0	0		
Windows: Steel casements.	0	95	Blast	Broken glass.
Finish: Plaster, wood trim.	0	0		
Contents: Office furniture.	0	0		

Remarks: Good condition except windows. Photo 253.

Consulate Office, Group 84

a. This group of buildings were located approximately 12,400 feet to 13,000 feet south of GZ. It consisted of one reinforced-concrete building, one wood-frame structure, and three brick buildings. They covered a plan area of 22,370 square feet and a floor area of 50,900 square feet. Building types and classification will be found on the following table.

A. No structural damage was found in the wood-frame or brick buildings.

c. The reinforced-concrete building which was located 12,400 feet from GZ had approximately 25 percent of the interior wood partitions displaced by the blast.

d. The Chinese consulate building, the only structure in this group with tile roofing, had approximately 50 percent of the tile displaced by the blast. Some superficial damage such as broken glass and mashed walls was observed in all the buildings in this area.

Building classification, Group 84

Building No.	Area		Type	Fire class	Construction		
	Plan	Total floor			Reinforced concrete	Load-bearing wall	Wood
1	6,720	11,100	F2	C		X	
2	3,850	7,700	F2	C		X	
3	2,500	7,500	F2	C			X
4	3,300	6,600	F2	C			
5	6,000	18,000	F2	R	X		
Total	22,370	50,900			1	3	1

DAMAGE ANALYSIS

Dimensions: 73 by 130 feet over all.
Ground floor area: 6,720 square feet.
Total area: 11,100 square feet.
Number of floors: 2.
Eave height: 31 feet.
Mean elevation: 10 feet.

Group 84.
Building No. 1.
Occupancy: British consulate.
Building type: Brick walls, wood roof (F2).
Fire classification: C.
Ground zero: 13,100 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Tar paper on flat wood	0	0		
Trusses: Wood	0	0		
Second floor: Wood flooring, wood joist	0	0		
First floor: Wood flooring, wood joist	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: 13-inch brick	0	0		
Interior walls: Wood frame and brick	0	75	Blast	
Windows: Plain glass, wood frames	0	0		
Finish: Wood trim and plaster	0	0		

Remarks: No structural damage. Superficial damage to windows only.

DAMAGE ANALYSIS

Dimensions: 55 by 70 feet.
Ground floor area: 3,850 square feet.
Total area: 7,700 square feet.
Number of floors: 2.
Eave height: 30 feet.
Mean elevation: 10 feet.

Group 84.
Building No. 2.
Occupancy: American consulate.
Building type: Brick walls, wood roof (F2).
Fire classification: C.
Ground zero: 13,000 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Tar paper on wood sheathing	0	0		
Trusses: Pitched wood truss	0	0		
Second floor: Wood flooring, wood joist	0	0		
First floor: Wood flooring, wood joist	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Brick	0	0		
Interior walls: Wood frame and brick	0	0		
Windows: Plain glass, wood frames	0	100		All glass broken.
Finish: Wood trim and plaster	0	0		

Remarks: No structural damage.

DAMAGE ANALYSIS

Dimensions: 50 by 50 feet.
Ground floor area: 2,500 square feet.
Total area: 7,500 square feet.
Number of floors: 3.
Eave height: 55 feet.
Mean elevation: 10 feet.

Group 84.
Building No. 3.
Occupancy: Offices.
Building type: Brick walls, wood roof (F2).
Fire classification: C.
Ground zero: 12,700 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Asbestos shingles on wood sheathing	0	0		
Trusses: Wood	0	0		
Third floor: Wood flooring, wood joist	0	0		
Second floor: Wood flooring, wood joist	0	0		
First floor: Wood flooring, wood joist	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: 13-inch brick	0	0		
Interior walls: Wood lath and plaster	0	0		
Windows: Plain glass, wood frames	0	100	Blast	Glass only broken.
Finish: Wood trim and plaster	0	0		

Remarks: No structural damage in this building.

DAMAGE ANALYSIS

Dimensions: 55 by 60 feet.
Ground floor area: 3,300 square feet.
Total area: 6,600 square feet.
Number of floors: 2.
Eave height: 25 feet.
Mean elevation: 10 feet.

Group 84.
Building No. 4.
Occupancy: Chinese consulate.
Building type: Wood frames (F2).
Fire classification: C.
Ground zero: 12,500 feet.

Construction	Damage			Description of damage
	Structural (per cent)	Superficial (per cent)	Cause	
Roof: Tile on wood sheathing	0	50		Tile loosened from sheathing.
Trusses: Wood	0	0		
Second floor: Wood flooring, wood joist	0	0		
First floor: Wood flooring, wood joist	0	0		
Foundation: Concrete walls	0	0		
Exterior walls: Stucco on wood frame	0	0		
Interior walls: Wood lath and plaster	0	0		
Windows: Plain glass, wood frames	0	100		All glass broken.
Finish: Wood trim and plaster	0	0		

Remarks: No structural damage in this building.

DAMAGE ANALYSIS

Dimensions: 110 by 110 feet over all.
Ground floor area: 6,000 square feet.
Total area: 18,000 square feet.
Number of floors: 3.
Eave height: 45 feet.
Mean elevation: 10 feet.

Group 84.
Building No. 5.
Occupancy: Japanese army hospital.
Building type: Reinforced concrete (E1).
Fire classification: R.
Ground zero: 12,400 feet.

Construction	Damage		Cause	Description of damage
	Structural (percent)	Superficial (percent)		
Roof: Reinforced-concrete slab.....	0	0		
Columns: Reinforced concrete.....	0	0		
Third floor: Reinforced-concrete slab.....	0	0		
Second floor: Reinforced-concrete slab.....	0	0		
First floor: Reinforced-concrete slab.....	0	0		
Foundation: Concrete walls.....	0	0		
Exterior walls: Reinforced-concrete walls.....	0	0		
Interior walls: Wood lath and plaster.....	0	25	Blast	All glass broken and repaired.
Windows: Plain glass, steel frames.....	0	100	do	
Finish: Wood trim and plaster.....	0	0		

Remarks: No structural damage in this building. Photo 254.

38. Minamioura Grade School, Group 88; Tomachi Grade School, Group 91

a. Group 88 buildings, located 15,600 feet south of GZ on a hillside at an elevation of approximately 250 feet above sea level, consisted of two two-story, wood-frame buildings, covering a total area of approximately 10,000 square feet, and several small wooden sheds of little importance. The principal buildings were on concrete foundations and roofed with tile.

b. Group 91, covering a total area of approxi-

mately 27,500 square feet, was located 19,000 feet south of GZ. The structures consisted of one three-story, reinforced-concrete, three two-story, wood-frame, and two one-story wood-frame buildings. The concrete building was constructed with heavy reinforced columns, beams, and slab floors and roof. The wood frame buildings were on concrete foundation, sided with wood and roofed with tile. No damage of any kind was caused to these buildings by the atomic bomb. Photos 254 and 255 show general views of these buildings.



PHOTO 1.—5,900 feet from GZ. Group 1, Buildings 5 and 6 from roof of Building 7.



PHOTO 2.—Group 1, south courtyard, Building 7.



PHOTO 3.—Group 1, damage to roof of Building 7A.



PHOTO 4.—Group 1, view of collapsed roof of Building 9.



PHOTO 5.—Group 1, west wing of Building 9.

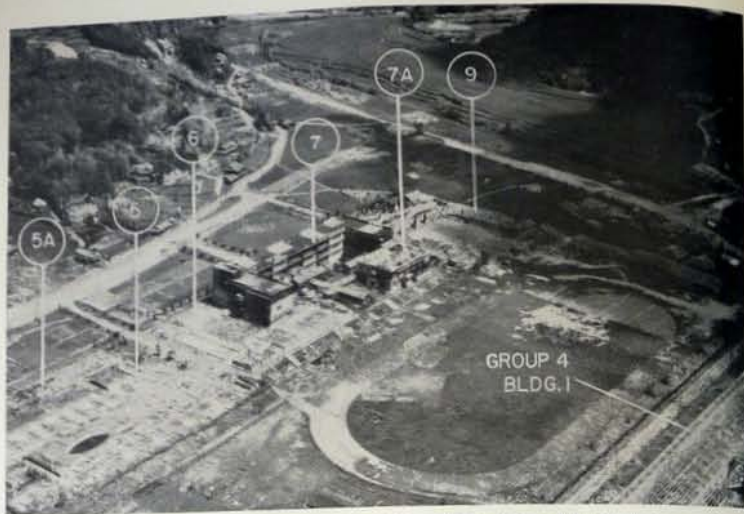


PHOTO 6.—5,900 feet from GZ. Group 1, aerial view of Nagasaki Boys' Normal School, looking northeast.



PHOTO 7.—5000 feet from GZ. Group 1, aerial view of Building 7.



PHOTO 8.—3,900 feet from GZ. Group 1, west side of Building 7.



PHOTO 9.—5,900 feet from GZ. Group 1, courtyard south of Building 7.



PHOTO 10.—Group 1, high-explosive bomb damage to third floor, Building 7.



PHOTO 11.—Group 1, high-explosive bomb damage to third floor, Building 7.

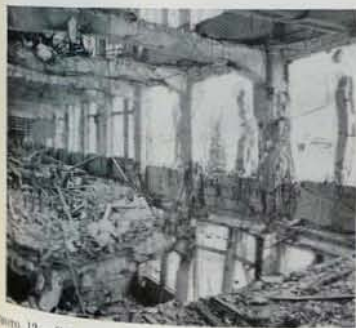


PHOTO 12.—Group 1, high-explosive bomb damage to second floor, Building 7.



PHOTO 13.—Group 1, high-explosive bomb damage to second floor, Building 7.

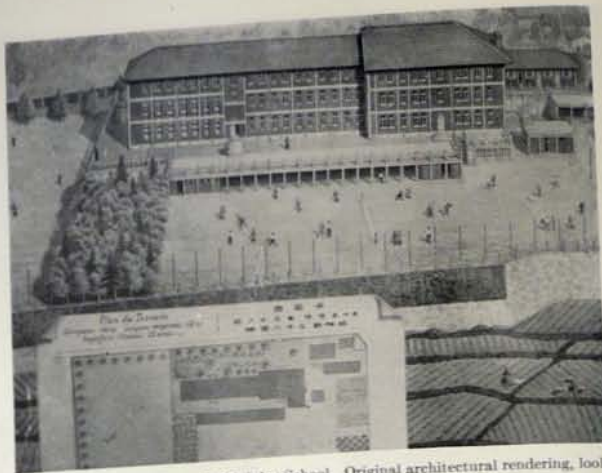


PHOTO 14.—4,800 feet from GZ. Group 7, Divinity School. Original architectural rendering, looking northwest.



PHOTO 15.—4,800 feet from GZ. Group 7, Divinity School. Photograph taken in 1939.



PHOTO 16.—4,800 feet from GZ. Group 7, Building 1, looking northeast, Divinity School.

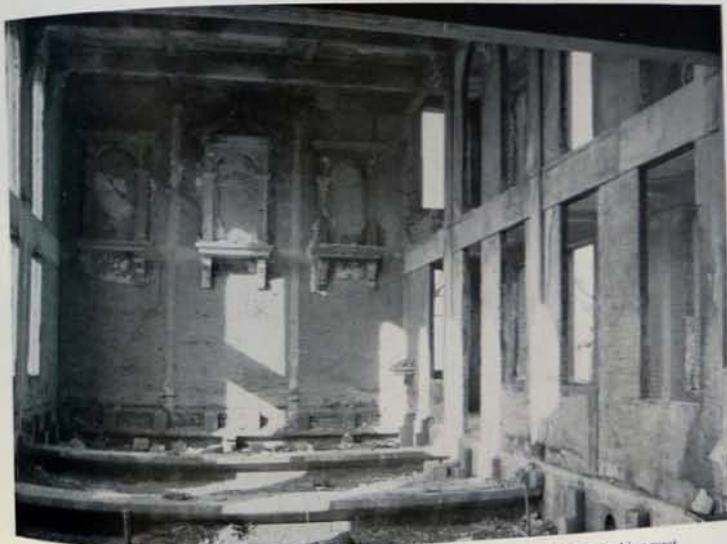


PHOTO 17.—4,800 feet from GZ. Group 7, Building 1, damage on first floor, looking west.



PHOTO 18.—4,800 feet from GZ. Group 7, Building 1, damage on third floor, looking east.



PHOTO 19.—Group 7, Building 1, looking southeast at north wall.



PHOTO 20.—Group 7, Building 1, roof destroyed by fire, looking west at damage on third floor.



PHOTO 21.—Group 7, Building 1, looking northeast at south side.



PHOTO 22.—Group 7, Building 1, looking west at damage on third floor.



PHOTO 23.—2,200 feet from GZ. Group 8, aerial view looking north at Yamamoto School.



PHOTO 24.—2,200 feet from GZ. Group 8, aerial view looking east.



PHOTO 25.—2,200 feet from GZ. Group 8, Building 1, looking north at fire damage on second floor.



PHOTO 26.—Group 8, Building 1, general view, looking northwest.



PHOTO 27.—Group 8, Building 1, south wall of north wing.



PHOTO 28.—2,200 feet from GZ. Group 8, Building 1, looking south at cracked roof beams in center wing.



PHOTO 29.—Group 8, Building 1, looking northeast at roof from third floor of south wing.



PHOTO 30.—2,200 feet from GZ. Group 8, Building 1, looking north at fire damage on third floor.



PHOTO 31.—Group 8, Building 1, deflected parapet wall on north side of south wing.



PHOTO 32.—Group 8, Building 1, cracked roof of south wing.



PHOTO 33.—Group 8, Building 1, cracked second floor beams at north wall of north wing.



PHOTO 34.—Group 8, Building 1, deflected parapet wall on north side of north wing.



PHOTO 35.—2,500 feet from GZ. Group 9, Building 1, looking west at remaining debris.



PHOTO 36.—Group 9, general view of debris, looking northwest.



PHOTO 37.—3,600 feet from GZ. Group 10, aerial view looking north, Nagasaki Commercial School.



PHOTO 38.—3,600 feet from GZ. Group 10, Building 3, looking northeast on second floor.



PHOTO 39.—Group 10, Building 8, general view looking south.



PHOTO 40.—Group 10, Building 3, general view looking west.



PHOTO 41.—3,600 feet from GZ. Group 10, Building 3, looking southwest on second floor.



PHOTO 42.—3,600 feet from GZ. Group 10, Building 3, cracked roof slab and beams, looking east in south wing



PHOTO 43.—3,600 feet from GZ. Group 10, Building 8, typical column failure.



PHOTO 44.—Group 10, Building 8, failure at east wall.



PHOTO 45.—3,600 feet from GZ. Group 10, Building 8, typical truss failure.



PHOTO 46.—Group 10, Building 3, damage by fire and blast.



PHOTO 47.—Group 10, Building 3, looking north in south wing.



PHOTO 48.—Group 10, Building 3, looking east at west side.



PHOTO 49.—Group 10, Building 8, damaged machine tools.



PHOTO 50.—1,000 feet from GZ. Group 13, Building 2, photo taken in 1935 of Nagasaki Prison Office.



PHOTO 51.—1,000 feet from GZ. Group 13, general view looking northeast across prison grounds.



PHOTO 52.—1,000 feet from GZ. Group 13, general view looking north. Part of prison wall remains standing.



PHOTO 53.—1,000 feet from GZ. Group 13, view of debris of cell blocks.



PHOTO 54.—1,000 feet from GZ. Group 13, debris of office building in foreground; concrete stack remains standing at left of photo.



PHOTO 55.—1,000 feet from GZ. Group 13, timber debris in foreground only unburned wood at the site.



Photo 56.—1,900 feet from GZ. Group 14, Building 1, aerial view looking southeast showing roof burned away and destroyed concrete walls. Urakami Cathedral (Group 15) at upper right corner.



Photo 57.—1,900 feet from GZ. Group 14, Building 1, general view looking northwest at school building.



Photo 58.—1,900 feet from GZ. Group 14, Building 3, charred remains of wooden structure. Machine tools in photo were housed in this building.



Photo 59.—Group 14, Building 1, north wall broken and leaning north at third-floor line. Photo taken from top of debris of south wall collapsed on third floor.



Photo 60.—Group 14, Building 1, exposed reinforcing steel in column 8D at third-floor level, Building 3 (Group 15) in upper left corner of photo.



Photo 61.—Group 14, Building 1, looking southeast at Column 5A above third-floor line. Third-floor slab buckled upward.



Photo 62.—Group 14, Building 1, looking northeast at north wall leaning north at third-floor line. Column 4D in foreground.



Photo 63.—Group 14, Building 1, looking west on first floor showing undamaged machines.



Photo 64.—Group 14, Building 1, interior view looking northwest on first floor. Concrete column at upper right has fallen from third floor.



Photo 65.—Group 14, Building 1, interior view looking west on second floor showing fractured third-floor beams.



Photo 66.—Group 14, Building 1, looking northwest at Column 6B shattered 8 feet above second floor.



Photo 67.—1,900 feet from GZ. Group 14, Building 1, looking west on second floor showing failure of columns at window sill height and beams at intermediate longitudinal beam point. Note third-floor slab buckled upward.



Photo 68.—1,900 feet from GZ. Group 14, Building 1, Column 6A cracked at point 3 feet above second floor. Typical of failure in column rows A.



Photo 69.—Group 14, Building 1, cracks on south side of Column 6C. Typical of failure at base of all interior columns.



Photo 70.—Group 14, Building 1, looking southwest at top of Column 6B. Typical of cracks at top of columns in column rows B and C.



PHOTO 71.—Group 14, Building 1, looking northwest and up at Beam 3 supporting third floor. Fracture shown is 9 ft from south wall.



PHOTO 72.—Group 14, Building 1, looking northwest and up at Beam 5 supporting third floor. Typical of beam failure adjacent to south wall in Beams 3, 5, 6, and 7.



PHOTO 73.—Group 15, Building 1, interior view prior to atomic-bomb attack.



PHOTO 74.—Group 15, Building 1, looking east at main entrance to cathedral prior to atomic-bomb attack.

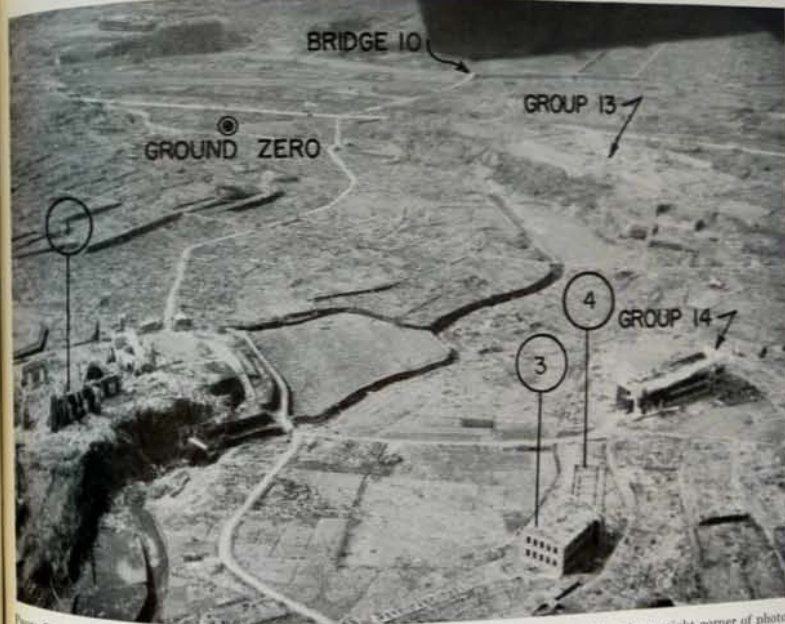


PHOTO 75.—Group 15, aerial view looking west. Building 1 at left and Buildings 3 and 4 at lower right corner of photo. Also shown are Nagasaki Prison (Group 13), at upper right corner and Deaf and Blind School (Group 14) at right center. Ground zero is also shown.



Photo 76.—1,800 feet from GZ. Group 15, Building 1, view looking east at main entrance to Catholic cathedral, showing shattered 28-inch brick walls.



Photo 77.—1,800 feet from GZ. Group 15, Building 1, looking west at ruins of cathedral. Note concrete dome blasted from west tower and resting in center of debris.



Photo 78.—Group 15, Building 1, looking northeast at remains of south wall of cathedral.



PHOTO 79.—Group 15, Building 1, concrete dome from southwest tower fallen into debris of building.



PHOTO 80.—Group 15, Building 1, concrete dome from northwest tower fallen into ravine 200 feet from cathedral.



PHOTO 81.—Group 15, Building 1, looking southeast at remains of south wall.



PHOTO 82.—2,200 feet from G.Z. Group 15, Building 3, view looking north showing roof burned away and leaning gable walls.



PHOTO 83.—2,200 feet from G.Z. Group 15, aerial view looking south. Foundations only remain of Buildings 4 and 5.

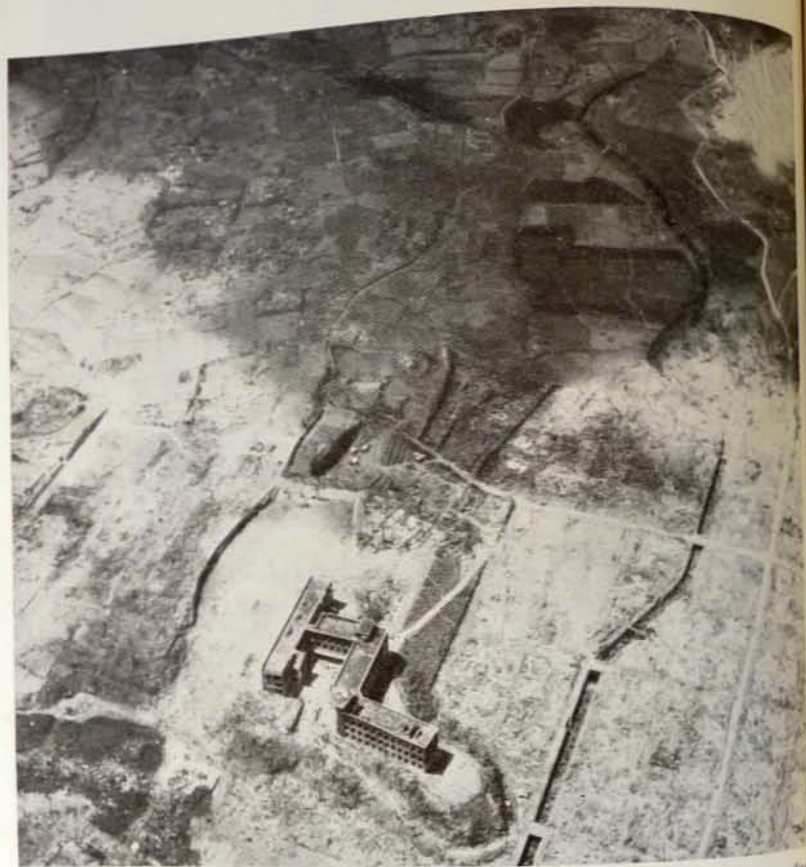


PHOTO 84.—1,600 feet from GZ. Group 16 photo taken 3 September 1945 showing east end of Building 2 still standing. The end of this building collapsed at a later date.



PHOTO 85.—1,600 feet from GZ. Group 16, ground photo taken 5 October 1945 showing east corner of Building 2 collapsed.



PHOTO 86.—Group 16, Building 1, close-up of crack in east wall of east wing.



Photo 87.—1,600 feet from GZ. Group 16, Building 1, cracked roof and parapet walls at west wall of west wing.



Photo 88.—Group 16, Building 1, roof Beam 21 thrust upward. See photo 97.



Photo 89.—1,600 feet from GZ. Group 16, Building 1, cracked roof Beams 3, 4, 5, and 6, west wing.



Photo 90.—Group 16, Building 1, small area not damaged by fire on third floor.



Photo 91.—Group 16, Building 1, blast and fire damage on third floor, center wing.



PHOTO 92.—1,600 feet from GZ. Group 16, Building 1, crack at base of columns at north wall of center wing.



PHOTO 93.—Group 16, Building 1, looking north at cracked roof deflected upward in east wing. Beams 23, 24, 25, and 26 shown.



PHOTO 94.—1,600 feet from GZ. Group 16, Building 1, cracked floor slab and beams of second floor in west wing. Beams 2, 3, and 4 shown.



PHOTO 95.—Group 16, Building 1, cracked third floor beams at west wall of west wing. Beams 4, 5, and 6 shown.



Photo 96.—Group 16, Building 1, looking up and west at concrete slab and beam of third floor in east wing. Section of slab north of crack thrust west $2\frac{1}{2}$ inches between column rows 20 and 21.



Photo 97.—Group 16, Building 1, roof Beam 20 thrust downward, Beams 21, 22, and 23 thrust upward. See Photo 88.



Photo 98.—Group 16, Building 1, looking up and south at typical columns failure at roof slab in west wing, Column 4B shown.



Photo 99.—Group 16, Building 1, looking directly up at Beam B, shown in Photo 96. Portion of beam at top of photo thrust west between column rows 20 and 21.



PHOTO 100.—Group 16, Building 1, looking up and east at crack in second floor slab in east wing between columns nos. 26 and 27. Section of slab north of crack thrust west $1\frac{1}{2}$ inches.



PHOTO 101.—Group 16, Building 1, looking northeast at base of Column 19B, second floor of east wing.



Photo 102.—Group 16, Building 2, looking west on third floor.



Photo 103.—Group 16, Building 1, looking north on roof of east wing, showing buckled roof slab.



Photo 104.—Group 16, Building 1, west wall and roof of east wing.



Photo 105.—Group 16, Building 1, fire damage at stair at east end of center wing.



Photo 106.—Group 16, Building 1, fire and blast damage to third floor of west wing.



Photo 107.—Group 16, Building 1, interior view of cracked north wall at second floor, east wing.



Photo 108.—Group 16, Building 2, top of south wall 30 feet from east end.



Photo 109.—Group 16, Building 2, looking south at collapsed east end.



Photo 110.—Group 16, Building 2, looking north at top of collapsed southeast corner.



Photo 111.—Group 16, Building 2, looking west at top of east end of collapsed wall.



Photo 112.—Group 16, Building 2, looking northeast at top of west wall.



Photo 113.—Group 16, Building 2, looking southeast at damaged stairwell on north side.



Photo 114.—1,500 feet from GZ. Group 17, general view of Nagasaki Medical College; photo taken about 1945.

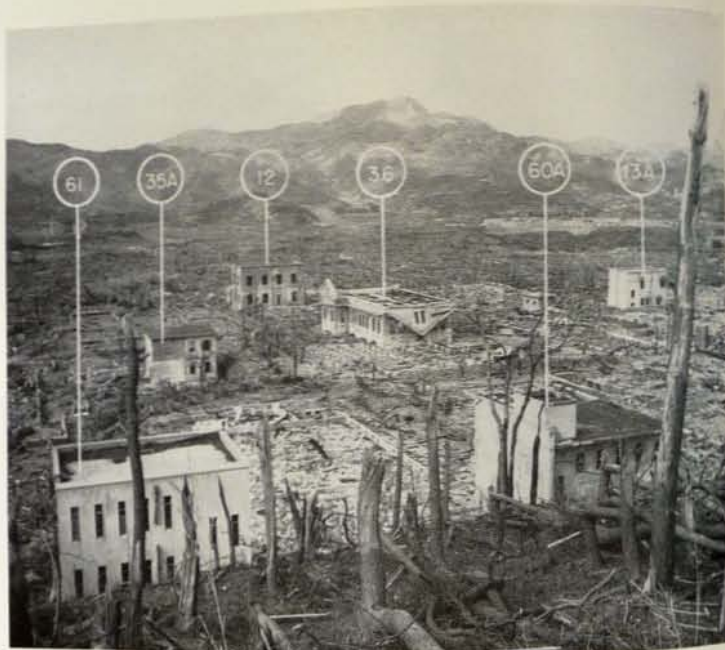


Photo 115.—1,500 feet from GZ. Group 17, general view of remaining buildings at Medical College.



Photo 116.—1,500 feet from GZ. Group 17, general view looking north over northeast portion of school site.



Photo 117.—1,500 feet from GZ. Group 17, Building 28, east concrete gable broken off at eave line and slumped to east.



Photo 118.—1,400 feet from GZ. Group 17, Building 12, cracked concrete walls on west side of building.



Photo 119.—1,500 feet from GZ. Group 17, Building 29, destroyed switch gear in north side of building.



Photo 120.—1,800 feet from GZ. Group 17, Building 61, complete combustion of paper contents stored in building.

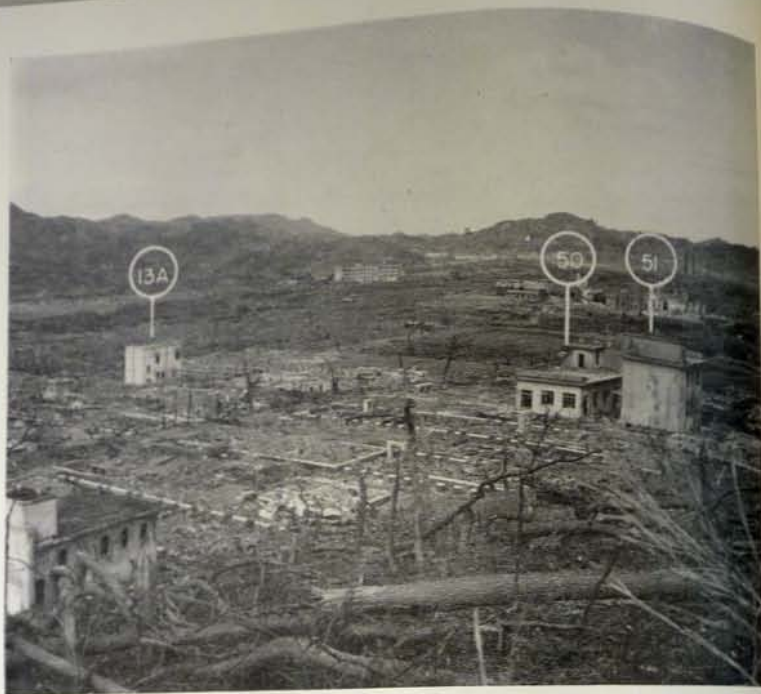


Photo 121.—1,500 feet from GZ. Group 17, general view looking northwest over debris of burned buildings.

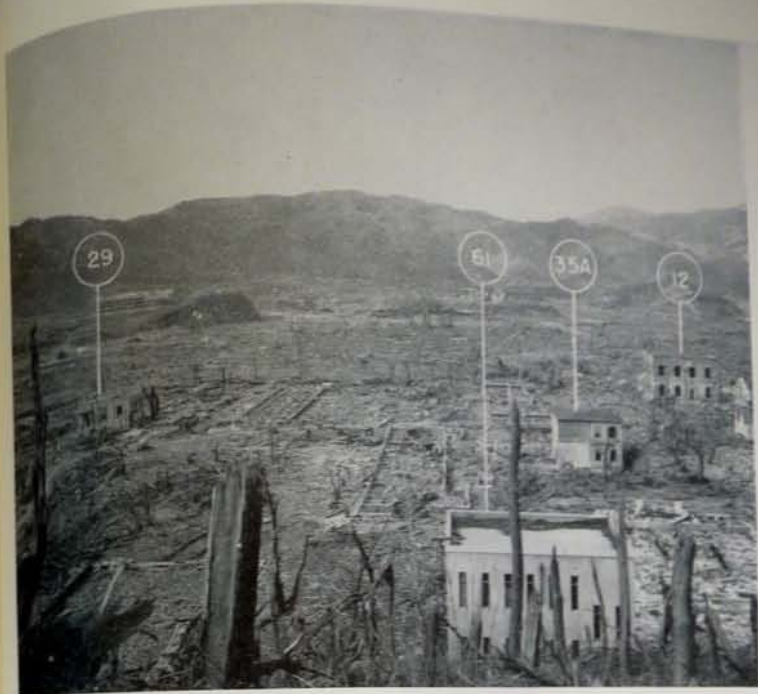


Photo 124.—1,500 feet from GZ. Group 17, general view looking west across debris of burned buildings.



Photo 122.—1,500 feet from GZ. Group 17, Building 35A, destroyed concrete panel walls at west side of building.



Photo 123.—Group 17, Building 35A, close-up of steel rods in concrete wall on west side of building.



Photo 125.—1,600 feet from GZ. Group 17, Building 51, west parapet wall collapsed in on roof.



Photo 126.—1,600 feet from GZ. Group 17, Building 50, east parapet wall broken at roof line and leaning east.



Photo 127.—1,500 feet from GZ. Group 18, Building 1. Aerial view looking west at Chinzei School.



Photo 128.—1,500 feet from GZ. Group 18, Building 1, reinforced concrete slab at east entrance to building.



PHOTO 129.—1,500 feet from GZ. Group 18, Building 1, general view of south end and east side of building.



PHOTO 130.—Group 18, Building 1, general view of south end and west side of building.



PHOTO 131.—1,500 feet from GZ. Group 18, Building 1, east wall collapsed at third floor line at north end of building.



PHOTO 132.—Group 18, Building 1, view of north end of building above third floor line. Photo taken from hill to north of building.



PHOTO 133.—1,500 feet from GZ. Group 18, Building 1, east wall at north end of building collapsed at third floor level.



PHOTO 134.—Group 18, Building 1, west wall at north end of building leaning west. Steel roof girders collapsed at east wall.



PHOTO 135.—1,500 feet from GZ. Group 18, Building 1, debris of wooden roof trusses, and leaning east wall above fourth floor level at south end of building.



PHOTO 136.—Group 18, Building 1, debris of wooden roof truss, and leaning west wall above fourth floor level at south end of building.



PHOTO 137.—1,500 feet from GZ. Group 18, Building 1, detail view of collapsed steel truss which supported roof over north portion of building.



PHOTO 138.—Group 18, Building 1, top chord of Truss 14 pulled away from steel plate riveted to steel column.



PHOTO 139.—1,500 feet from GZ. Group 18, Building 1, looking north at west end of steel trusses remaining attached to top of west wall.



PHOTO 140.—1,600 feet from GZ. Group 18, Building 2, debris of this wooden building which was completely demolished by blast.



Photo 141.—1,500 feet from GZ. Group 18, Building 1, floor slab and beam at west central section of first floor collapsed into basement.



Photo 142.—Group 18, Building 1, failure in Columns 8B on first floor, 9B on third floor, and 3B on first floor. Typical column failures throughout building.



Photo 143.—1,500 feet from GZ. Group 18, Building 1, interior view looking south on second floor showing fire and blast damage.



Photo 144.—Group 18, Building 1, interior view looking south on third floor, showing blast and fire damage.



Photo 145.—1,500 feet from GZ. Group 18, Building 1, damage to column 4D below second floor line.



Photo 146.—1,500 feet from GZ. Group 18, Building 1, interior view looking north on first floor showing blast and fire damage.



Photo 147.—Group 18, Building 1, interior view looking south on first floor. Second floor beams cracked near east wall.



PHOTO 148.—1,500 feet from GZ. Group 18, Building 1, interior view looking north at west wall leaning west at third floor line.



PHOTO 149.—Group 18, Building 1, Beam 10, between column rows B and C, supporting third floor. Crack shown is typical of these in center section of building.



PHOTO 150.—1,500 feet from GZ. Group 18, Building 1, east end of Beam 10AB supporting first floor. This beam depressed 7 inches in center of 22-foot span.



PHOTO 151.—Group 18, Building 1, west end of Beam 10AB supporting first floor. This beam was 13½ inches wide and 20 inches deep.



Photo 152.—1,500 feet from GZ. Group 18, Building 1, looking south at beam 4 supporting fourth floor. Failure typical of Beams 3, 4, 5, and 6 on this floor.



Photo 153.—Group 18, Building 1, looking south at Beam 12 supporting third floor. Cracks typical of failure in Beams 10, 11, 12, 13, 14, and 15 on this floor.



Photo 154.—1,500 feet from GZ. Group 18, Building 1, east end of Beam 9 supporting second floor cracks typical of failure in beams throughout building.



Photo 155.—Group 18, Building 1, base of Column 13A at third floor line.



Photo 156.—Group 18, Building 1, base of Column 13A at third floor line showing anchor bolts pulled from concrete.



Puoro 157.—2,200 feet from GZ. Group 20, aerial view looking northeast at Nagasaki University Hospital.



Puoro 158.—2,200 feet from GZ. Group 20, Building 17, north wall of building. Damage to roof and two-story section caused by high-explosive bomb prior to 9 August 1945.



Puoro 159.—2,100 feet from GZ. Group 20, Building 16, damaged west end and south side of building.



Puoro 160.—2,200 feet from GZ. Group 20, Building 18, west end and south side of building.



Photo 161.—2,300 feet from GZ. Group 20, Building 20, heavy concrete roof construction. All wood trim destroyed by fire.



Photo 162.—Group 20, Building 18, damage caused by high-explosive bomb to southeast corner of building prior to 9 August 1945.



Photo 163.—2,400 feet from GZ. Group 20, foundation walls remaining at east side of site. Building 3 at left of photo.



Photo 164.—2,500 feet from GZ. Group 20, Building 24, general view looking northwest. Concrete stacks from Building 23 in background.



Photo 166.—2,500 feet from GZ. Group 20, Building 24, first-floor beams showing typical heavy construction.



Photo 167.—2,400 feet from GZ. Group 20, Building 26, view in main lobby showing typical construction.



Photo 168.—2,400 feet from GZ. Group 20, Building 28, shattered brick walls and burned roof.



Photo 169.—2,100 feet from GZ. Group 20, Building 22 looking west from top of building 20 showing high-explosive bomb damage.

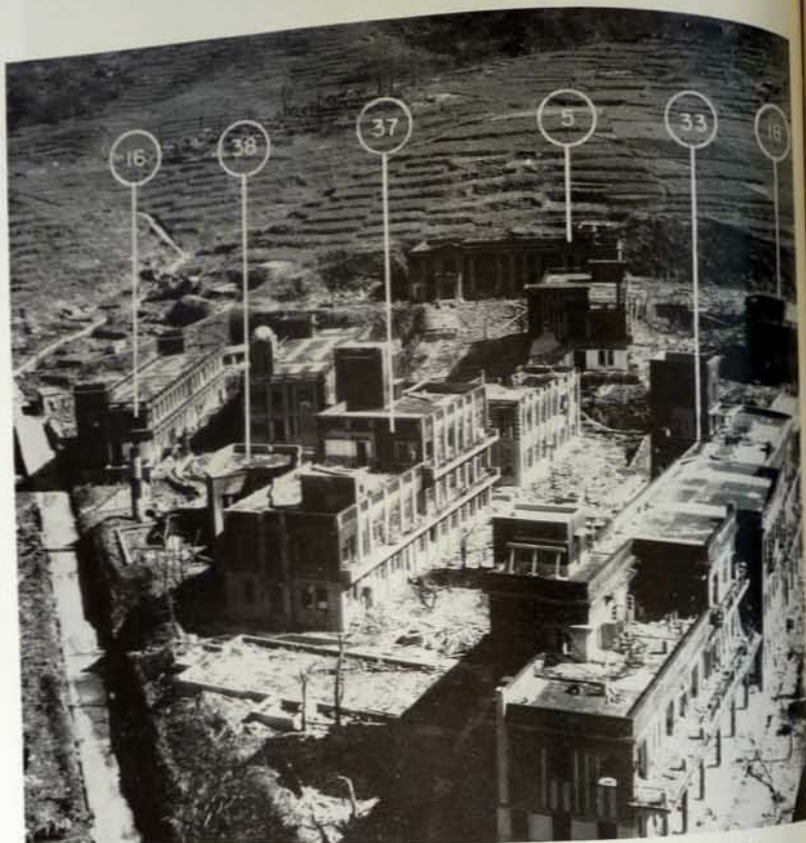


Photo 170.—2,200 feet from GZ. Group 20, aerial low oblique looking east, Building 33 at lower right corner.



Photo 171.—2,200 feet from GZ. Group 20, Building 29, interior view showing typical construction.



Photo 172.—2,400 feet from GZ. Group 20, Building 12, general view looking northwest.



Photo 173.—2,400 feet from GZ. Group 20, Building 11, general view looking northwest. Debris of Building 12 at left.



Photo 174.—2,200 feet from GZ. Group 20, Building 13, south side of undamaged building.



Photo 175.—2,200 feet from GZ. Group 20, Building 14, south side and west end of building.



Photo 176.—Group 20, Building 17, damage caused by high-explosive bomb prior to 9 August 1945.



Photo 177.—Group 20, Building 32, damage caused at southwest corner of building by high-explosive bomb prior to 9 August 1945.



Photo 178.—1,400 feet from GZ. Group 20, Building 33, general view of south side of building. Photo taken from roof of Building 20.



Photo 179.—1,800 feet from GZ. Group 20, Building 37, capping blown off top of parapet wall at northwest corner of building.



Photo 180.—1,800 feet from GZ. Group 20, Building 38, typical roof construction. Interior trim burned away.



Photo 181.—2,100 feet from GZ. Group 20, Building 5, undamaged west side and south end of building.

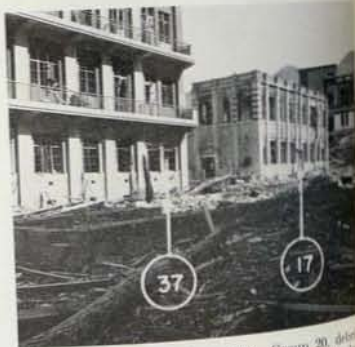


Photo 182.—1,800 feet from GZ. Group 20, debris of buildings 35 and 36; Buildings 37 and 17 at left.

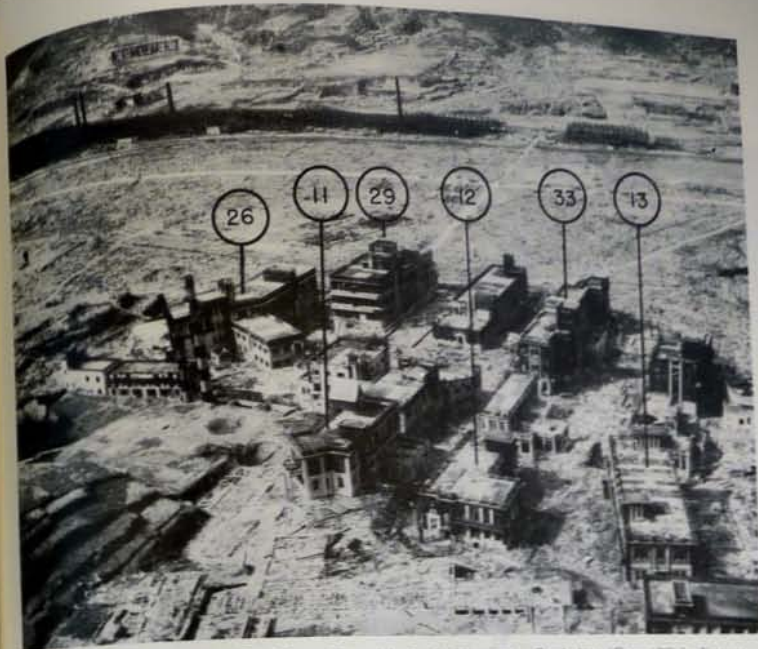


Photo 183.—2,200 feet from GZ. Group 20, aerial view looking west. Steel plant (Group 26) in distance.



Photo 184.—1,800 feet from GZ. Group 20, Building 38, parapet on east wall cracked at roof line.



Photo 185.—1,900 feet from GZ. Group 20, Building 38B general view looking northwest at remaining west wall.



Photo 186.—2,100 feet from GZ. Group 20, Building 32, interior view showing fire damage on first floor.



Photo 187.—Group 20, Building 32.



Photo 188.—Group 20, Building 32.



Photo 189.—Group 20, Building 32.



Photo 190.—Group 20, Building 32.



Photo 191.—Group 20, Building 32.



Photo 192.—Group 20, Building 18.

Photos 187 to 192.—2,200 feet from GZ. Complete combustion of contents in various rooms of reinforced-concrete hospital buildings.



PHOTO 193.—2,300 feet from GZ. Group 20, Building 19, partial view of burned interior.



PHOTO 194.—2,500 feet from GZ. Group 20, Building 20, interior of commissary. Second floor destroyed by fire.



PHOTO 195.—1,800 feet from GZ. Group 20, Building 37, view of east stair undamaged by fire, although combustible material in corridor was completely consumed.



PHOTO 196.—1,800 feet from GZ. Group 20, Building 21, ward, second floor, completely burned out.



PHOTO 197.—2,100 feet from GZ. Group 20, Building 32, intense fire in southeast corner of building.



PHOTO 198.—1,800 feet from GZ. Group 20, Building 26, complete destruction of interior of operating theater by fire.



PHOTO 199.—2,100 feet from GZ. Group 20, Building 32, burned stair at north side of building.



Photo 200.—2,500 feet from GZ. Group 20, Building 24, kitchen, first-floor commissary building burned out.



Photo 202.—2,200 feet from GZ. Group 20, Building 30, wood-framed infirmary completely destroyed by blast and fire.



Photo 204.—2,200 feet from GZ. Group 20, wood-framed passageway between Buildings 17 and 18 destroyed by blast and fire.



Photo 201.—2,400 feet from GZ. Group 20, Building 25, showing complete combustion of wood floor, burning door and window frames, in reinforced-concrete administration building.



Photo 203.—2,400 feet from GZ. Group 20, Buildings 7, 8, 9, and 10, looking north. Complete destruction by blast and fire.



Photo 205.—2,400 feet from GZ. Group 20, Building 8, completely destroyed by blast and fire.



Photo 206.—2,700 feet from GZ. Group 24, TB sanatorium destroyed by blast and fire.



Photo 207.—2,700 feet from GZ. Group 24, fallen trees behind sanatorium.



Photo 208.—2,800 feet from GZ. Group 25, looking south at remains of Keiho High School.



Photo 209.—Group 25, looking west showing complete destruction by blast.



Photo 210.—Group 25, looking southwest at general view of site.



Photo 211.—3,700 feet from GZ. Group 27, aerial view looking south at Fuchi School.



PHOTO 212.—3,700 feet from GZ. Group 27, low aerial view looking west.



PHOTO 213.—Group 27, Building 1, fire damage in stair and corridor.



PHOTO 214.—3,700 feet from GZ. Group 27, Building 1, typical beam failure on third floor.



PHOTO 215.—Group 27, Building 1, looking southwest at northeast side.



PHOTO 216.—Group 27, Building 1, looking southeast at southwest side.



Photo 217.—3,700 feet from GZ. Group 27, Building 1, looking northwest on third floor at fire damage.



Photo 218.—Group 27, Building 1, complete combustion on third floor.



Photo 219.—3,700 feet from GZ. Group 27, aerial view looking southeast.



Photo 220.—Group 27, Building 7, looking southwest at destroyed structure.



Photo 221.—Group 27, Building 2, looking south at destroyed roof.



Photo 222—Group 27, Building 8, looking southwest at destroyed structure.



Photo 223.—3,800 feet from GZ. Group 27, scorched land west of school.



Photo 224.—4,900 feet from GZ. Group 29, aerial view of Nagasaki Hygiene Experimental Center.



Photo 225.—4,900 feet from GZ. Group 29, remains of Nagasaki Hygiene Experimental Center.



Photo 226.—5,600 feet from GZ. Group 34, wooden Japanese type structures adjoining shrine.



Photo 227.—5,600 feet from GZ. Group 34, Fuchi Shrine, building in foreground collapsed. Shelter in background wrecked.



Photo 228.—5,600 feet from GZ. Group 34, Fuchi Shrine looking toward GZ.



Photo 229.—5,600 feet from GZ. Group 34, wood superstructure, unanchored, moved south 12 inches by blast.



Photo 230.—6,300 feet from GZ. Group 38, aerial view looking west at Inasa School. Damaged roof of Building 1 at bottom of photo.



Photo 231.—Group 38, Building 1, view of north end of steel frame building damaged by blast.



Photo 232.—Group 38, Building 3, typical concrete construction of structurally undamaged building. Plastered ceiling hung from wooden members have fallen.



Photo 233.—Group 38, Buildings 1, 2, and 3, general view looking north at damaged steel-frame building at right and undamaged concrete buildings at left.



Photo 234.—6,300 feet from GZ. Group 38, Building 4, view from roof of Building 2, showing wooden school buildings destroyed by blast.

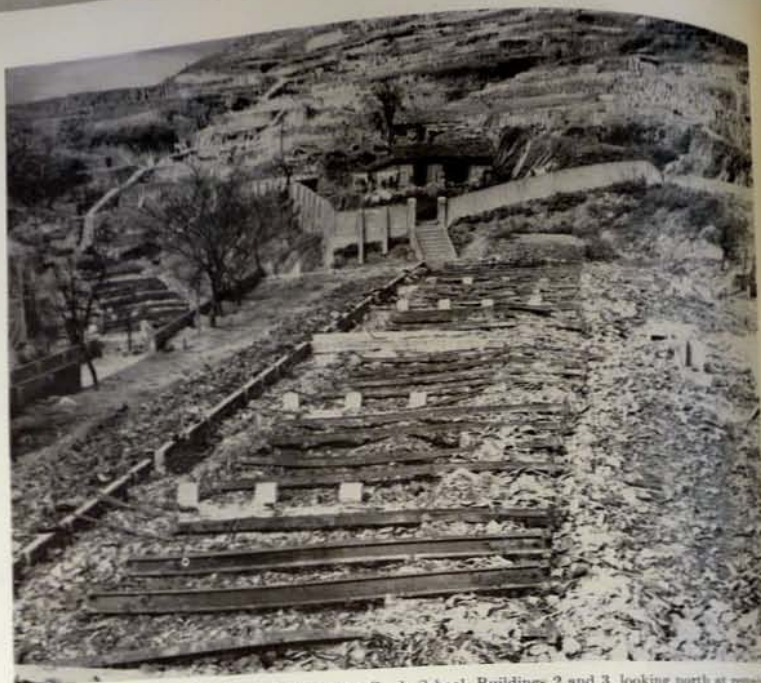


Photo 235.—6,800 feet from GZ. Group 42, Nishizaka Grade School, Buildings 2 and 3, looking north at remains and steel framing.



Photo 236.—6,500 feet from GZ. Group 42, Building 1, looking north at remains and steel framing.



Photo 237.—6,800 feet from GZ. Group 42, Building 4, looking northwest at remains.



Photo 238.—8,300 feet from GZ. Group 48, Building 2, Asahi School, looking northeast at blast damage to typical one-story Japanese school building.



Photo 239.—8,300 feet from GZ. Group 48, Building 4, wall of two-story, wood-frame building distorted by blast from atomic bomb.



Photo 240.—Group 48, Building 3 looking east at crater and debris caused by 500-pound, high-explosive bomb prior to atomic-bomb attack.



Photo 241.—8,800 feet from GZ. Group 70, Building 1, general view, looking southwest at Nakamaehi Church.



Photo 242.—8,800 feet from GZ. Group 70, Building 1, aerial view, looking south at burned-out interior of church.

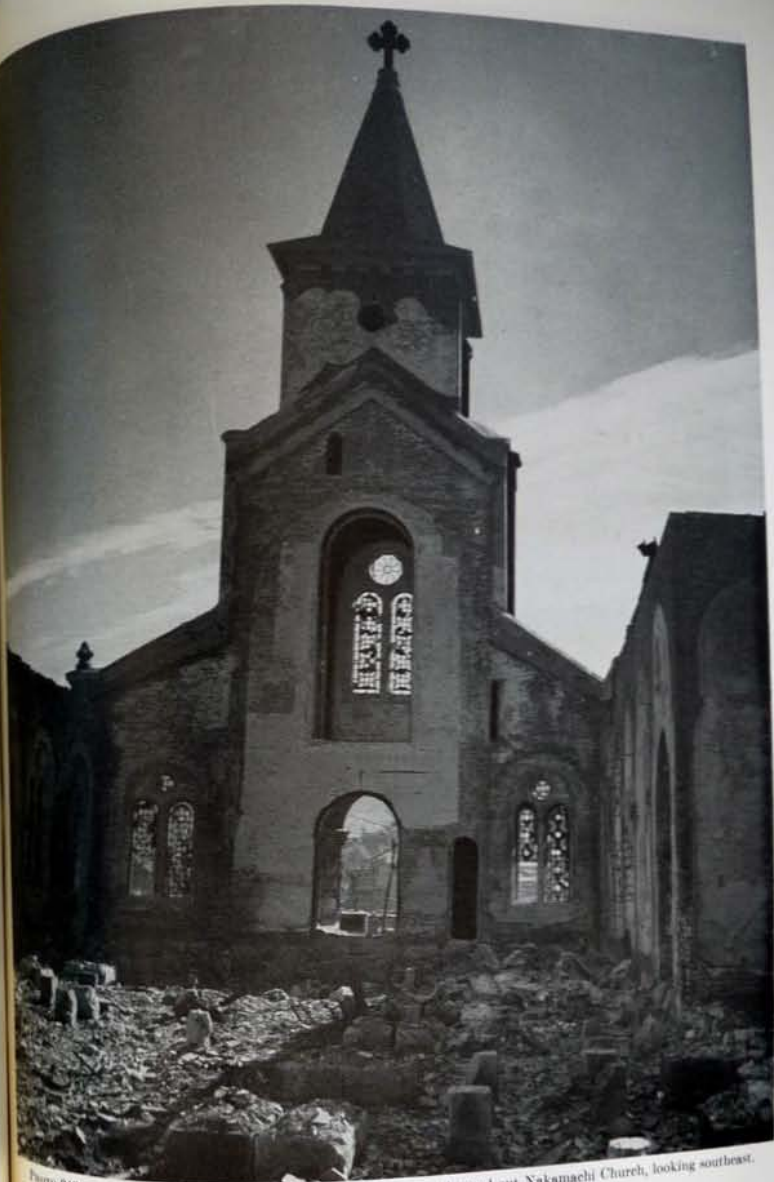


Photo 243.—8,800 feet from GZ. Group 70, interior view of burned-out Nakamaehi Church, looking southeast.



PHOTO 244.—9,800 feet from GZ. Group 73, looking south at Building 1.



PHOTO 245.—9,800 feet from GZ. Group 73, Shinkoozen Grade School, looking northeast at west side of Building 2.

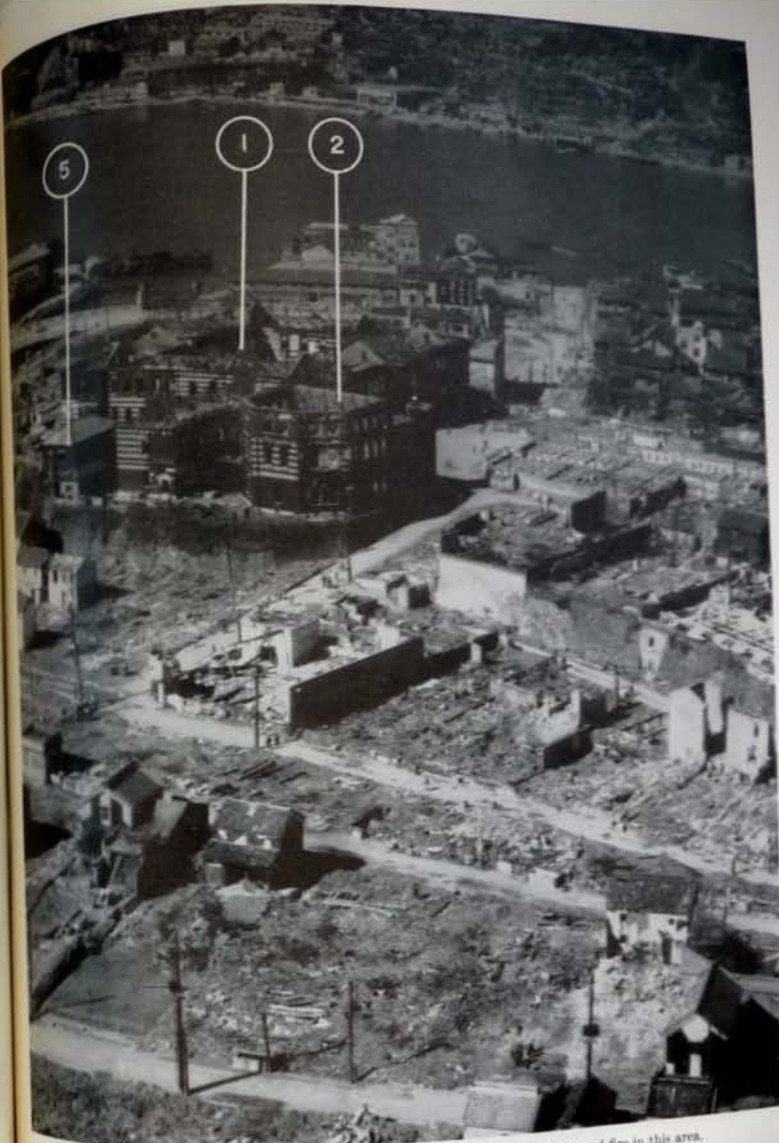


PHOTO 246.—10,900 feet from GZ. Group 81, destruction by blast and fire in this area.



PHOTO 247.—10,900 feet from GZ. Group 81, Building 1, looking northwest at prefectural offices. Building 2 foreground was removed prior to the attack.



PHOTO 248.—10,900 feet from GZ. Group 81, Building 1, looking west. Part of Building 2 at right.



PHOTO 249.—10,900 feet from GZ. Group 81, Building 2, looking northwest.



PHOTO 250.—10,900 feet from GZ. Group 81, Building 3, looking southwest.



Photo 251.—12,400 feet from GZ. Group 83, looking southwest at post office.



Photo 252.—12,400 feet from GZ. Group 83, looking west at post-office annex.



Photo 253.—12,400 feet from GZ. Group 83, looking northwest at telegraph office.



Photo 254.—19,000 feet from GZ. Group 91, Tomachi Grade School, looking north at concrete building.



Photo 255.—19,000 feet from GZ. Group 91, looking south at typical wood building.

39. Material Tests

a. Samples of concrete, reinforcing steel and roof tiles taken from buildings in Nagasaki were sent to the National Bureau of Standards in Washington, D. C., to be tested. The results of the tests are given in the report by the Bureau of Standards which follows.

b. The sample identification listed in the Bureau of Standards report will be found in this physical damage report as follows:

Sample identification	Part No.	Group No.	Building No.
A-29	2	26	29
W-1	3	16	1
W-2	3	16	2
J-1	2	4	1
L	3	13	Wall
BBB	3	18	1
BB	3	14	1

c. The roof tiles tested were taken from structures within a 900-foot radius of GZ.

40. Report from National Bureau of Standards (copy)

TMK: MMR.
IX-6,963-M-492.

UNITED STATES DEPARTMENT OF COMMERCE

WASHINGTON

NATIONAL BUREAU OF STANDARDS

Report of tests of samples of concrete, reinforcing steel, and roof tile

Submitted by United States Strategic Bombing Survey, Physical Damage Team No. 2, Gravelly Point, Va.

Reference: (1) Letter of 12, February 1946, signed by Richard J. Perry, 1st Lt. AC, Adjutant, United States Strategic Bombing Survey, Gravelly Point, Va.

(2) P. O. No. 12786-R dated 1 March, 1946, Procurement and Accounting Division, War Dept., Washington, D. C.

Procurement Authority: S-49-083-632-1192 P
711-07 A212/60103.

I. Concrete samples.

A. Test results:

Sample identification	Dry weight (pounds per cubic foot)	Is-hair water absorption (percent of dry weight)	Compressive strength (p.s.i.)
A-29	133	8.2	2,330
W-1	136	7.6	2,330
W-2	144	5.3	1,900
J-1	136	6.7	2,900
L	130	7.7	2,900
BBB	130	8.2	1,830
BB-1	138	6.1	1,830

* Sample marked "W-1" was cracked to such an extent that it could not be easily broken into small fragments with the hands. It was impossible to procure compressive strength specimens from the sample.
* Previously dried at 105°-110° C. to constant weight.
* Compressive strength values corrected for 1/4 ratio of specimen, in accordance with ASTM Specification C42-44.

II. Steel reinforcement samples.

A. Test results:

Sample identification	Dimensions of cross section in—	Yield point (p.s.i.)	Tensile strength (p.s.i.)	Elongation in 2 inches (percent)
L	0.380 (diameter)	37,800	53,600	14.1
W-1	0.349	38,300	57,300	17.2
A-29	0.458 x 0.348	65,000	74,300	2.2
BB	0.350 (diameter)	46,800	67,000	19.2
W	0.374 (diameter)	45,700	56,800	21.3

* This value is approximate, since yield point was not well defined.

III. Roof tile samples.

A. The material of which the tile samples are composed becomes liquid at 1,300° C.

B. A blistered surface, similar to the surface of the samples submitted, can be produced by heating the tile to 1,800° C. for a period of 4 seconds by means of a gas oxygen blast lamp.

C. It may be assumed, however, that the tile samples submitted were subjected to a temperature higher than 1,800° C. and of a shorter duration than 4 seconds, since the depth of penetration of the heat effects was greater in laboratory tests than in the sample submitted.

The contents of this report are not to be used for advertising, publication or promotional purposes.

For the Director,

By J. Tucker, Jr.

(S) J. TUCKER, Jr., Chief,
Cement and Concreting Materials Section,
Division of Clay and Silicate Products.

MARCH 12, 1946.

WASHINGTON, D. C.

Structural Summary of Nagasaki Building

Code

Wind loads.
Structures to 6 meters (19.7 feet) in height... 15.25
Structures over 6 meters in height... 20.4
Chimneys, stacks, fire towers, etc., over 15 meters (49.2 feet) in height... 30.6

Dead live loads on floors and roofs for different types of buildings.

	Pounds per square foot
Floors.	
Residential, hotel or hospital rooms	40.8
Office rooms, stores, public dining rooms	61.6
School rooms	71.4
Gymnasium, dancing hall	81.5
Auditorium, theater, public hall	91.6
Shop	71.4
Garage	102.0
Automobile passage ramps	204.0
Warehouse	81.5
Roof gardens:	
1. Residential	30.6
2. Play areas	71.4
3. Public gatherings	91.6
Hall or lobby areas:	
1. Residential	40.8
2. Connecting (c) or (d) above	71.4
3. Connecting (e) above	91.6
4. Connecting others	61.6
5. All other floors	61.6

Roofs.
Snow load per 10 cm. (4 inches) in thickness... 6.16

Equal allowable soil pressure.

	Tons per square foot
Rock bed 1/2 allowable compressive stress of rock	9.26
Shale bed	5.55
Gravel layer compacted	5.55

(4) Gravel layer not compacted	2.78
(5) Sandy gravel layer compacted	4.63
(6) Sandy gravel layer not compacted	1.85
(7) Sand layer compacted	4.16
(8) Sand layer not compacted	92
(9) Sandy clay, clay and loam compacted	2.78
(10) Sandy clay, clay and loam not compacted	92
(11) Silt	0
d. Allowable stresses.	

(1) Reinforcing steel.	Pounds per square inch
Compression	17,000
Tension	17,000
Shear	11,350
Bending	17,000

(2) Structural steel. Same as (1) above.	
(3) Reinforced concrete.	Pounds per square inch
Compression	993.0 (1/2 comp strength)
Tension	99.3 (1/2 comp strength)
Shear	99.3 (1/2 comp strength)
Bond plain bar	99.3
Bond deformed bar	142
(Remark: Concrete in reinforced concrete shall have a compressive strength of over 1,278 pounds per square inch.)	

(4) Woods.

	Lbs per sq in			
	Comp.	Tension	Shear	Bond
Cryptomeria				
Soft pine	832.00	982.00	98.20	982.00
Fir				
American cryptomeria	982.00	1,132.00	113.20	1,132.00
American plum				
American cypress				
Pine	1,132.00	1,278.00	127.80	1,278.00
Red pine				
Black pine				
American pine	982.00	1,132.00	113.20	1,132.00
Cherry				
Oak	1,132.00	1,380.00	138.00	1,380.00
Zelkova				
Red oak	1,278.00	1,526.00	152.60	1,526.00
White oak				

PART 4

EFFECTS OF ATOMIC BOMB ON PUBLIC UTILITIES

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FRONTISPIECE

... all the electrical works in the entire city were damaged by the bombing and the transmission of power within the city was impossible."

Nagasaki Prefecture Report

I. OBJECT OF STUDY

The purpose of this report is to describe the damage to public utilities caused by the atomic

bomb which detonated above Nagasaki on 9 August 1945.

II. SUMMARY

5. Gas Supply System

a. Two coal-gas producing plants were situated approximately 3,000 and 6,600 feet, respectively, from GZ. One gas holder at 3,000 feet from GZ was struck by the blast wave which caused a low-order explosion and resulted in the complete destruction of the holder. Two others, located 6,600 feet from GZ, were also struck by the blast wave. The tank tops collapsed, but there was no explosion. Both holders, however, were heavily damaged. Gas ovens (retorts) and producing equipment suffered only slight blast damage. Gas mains were not studied, but it was assumed that breaks occurred in proportion to those on water mains (Water Supply Systems, Par. 7).

b. The gas supply was completely disrupted, and would have impeded production seriously in the industrial plants for approximately 7 months. To resume full operation would have required 400,000 man-hours repair time (Sec. III, General Information, Par. 10).

6. Electric Power Supply

a. The electric supply system within the damaged area consisted of 8 transformer stations; 2 switch stations; and 1 small generating plant. The capacity of the power transformers (66/2.5 kilovolts) was 96,000 kilovolt-amperes which supplied 40,842 residential consumers and 949 industrial consumers before the date of the atomic-bomb attack. There was no electric power for 2 days thereafter, and even when emergency repairs had been made, only 7,000 residential consumers and 350 industrial consumers could be supplied. After 3 months, sufficient repairs had been effected to serve 23,459 residential and 409 industrial consumers.

b. Of a total of 17,219 kilometers of 66 kilovolt open transmission lines, mainly supported on steel towers and concrete standards, 5,598 kilometers or 32.4 percent were damaged; 2,725 kilometers had been rebuilt by 1 November 1945. Eight steel towers of a total of 76 and 4 concrete standards of a total of 30 were damaged beyond repair.

The damage inflicted on the distribution system was heavy and is summarized as follows:

Damage to distribution system

Item	Before the attack	Destroyed	Percentage destroyed
Line length (miles).....	133.4	37.0	27.7
Number of poles.....	6,107	1,491	24.0
Number of transformers (13,954 kilovolt-amperes).....	1,750	483	27.6

Damage to transformer stations was comparatively light. Of 8 stations, 3 sustained heavy damage to bus structures, insulators, bushings, and steel racks. Only slight damage was sustained by the primary heavy equipment.

To complete all repairs would have required approximately 75,000 man-hours.

Water Supply Systems

a. Water was supplied from four reservoirs within 16,000 feet of GZ. Four systems of emergency interconnections were in operation, each being supplied by a different reservoir. Failures occurred in 12-inch mains 3 feet below ground. These failures may be traced to an undue displacement of the soil caused by pressure from the blast wave. No evidence of damage by falling debris or by any other causes was discovered. Four breaks were located within the same area on other water mains crossing two bridges. The bridges were displaced by the blast, shearing the mains at the abutments. On branch and distribution pipes many breaks were caused by collapsing structures. Slight damage to the blast was sustained by the following equipment at the reservoirs:

1. Station venturi meters (housed in wooden structures).

2. Electric installation for pump equipment at Izakami (10,500 feet from GZ).

3. The water supply system, already taxed to the limit, was in no position to meet the demand for water required by fire fighting. Within 24 hours, however, sufficient emergency repairs were carried out to meet a portion of the population's demand.

4. The repair time required to reestablish the system on a permanent basis was estimated to be 200,000 man-hours.

8. Telephone and Telegraph System

The telephone and telegraph system was partly paralyzed for a week after zero hour, thereby causing delay in organizing adequate rescue work. The damage is summarized as follows:

a. Telephone.

Total length of underground cables..... 149 mi.
Heavily damaged..... 16 mi.—10.8%
Total length of aerial cables..... 49 mi.
Heavily damaged..... 30 mi.—62%
Total length of open wires..... 66 mi.
Heavily damaged..... 26 mi.—40%
Subscribers' telephones..... 4,891 sets.
Destroyed and heavily damaged..... 2,920 sets—60% aged.

b. Telegraph.

Total length of open wires..... 129 mi.
Damaged in various degrees..... 19 mi.—15%.

c. Estimated repair time for telephone and telegraph systems was 75,000 man-hours.

9. Street Railway System

a. A double-track street railway system transported daily 77,000 commuters. The overhead power lines with a potential of 600 volts, direct current, were supported by steel standards.

b. Damage to the system was as follows:

(1) Thirty-nine cars (70 percent) (all that were within 10,000 feet of GZ) were badly damaged by blast and fire.

(2) One and two-tenths miles (5 percent) of track were damaged because of burning sleepers which caused the rails to buckle. The fire was secondary and undoubtedly caused by burning debris.

(3) Five and nine-tenths miles (50 percent) of trolley wire were damaged by blast.

(4) One and five-tenths miles of power lines were torn down and 4½ miles of electric light wires were damaged (50 percent).

(5) Five percent of the total number of steel supports for overhead power lines sheared off or overturned.

c. Estimated time to complete repairs was 200,000 man-hours.

10. Railroad

a. Railroad facilities consisted of a single-track line running due north within the city, connecting it with Tosu Junction. This line terminated at the Nagasaki station and served three other secondary stations within the city limits. Many passengers utilized this road as a means of transportation within the city and its suburbs.

b. Although the damage to equipment was not extensive it was severe enough to curtail traffic for 48 hours, during which time sufficient emergency repair work was effected so that limited traffic could be resumed. The major damage was sustained by the track and railroad bridges. The wooden cross-ties were burned intermittently for a distance of 10,000 to 15,000 feet, causing the rails to buckle at these points. The fire was secondary, resulting from contact with burning

debris. Three bridges were displaced, distorting the rails and necessitating complete rebuilding of the tracks. The railroad stations were completely destroyed by blast and fire, and the electric signal system was severely damaged. Railroad stock sustained slight damage, primarily by blast. c. In order to rebuild the station buildings and repair all the damage to tracks and signal systems it was estimated that 100,000 man-hours would be required.

Summary of damage, public utilities

Systems	Maximum distance (feet) from G.E. (if damaged)	Damage cause	Over-all damage	Repair time (man-hours)	Parts damaged
Electric	10,500	Blast and fire	35 percent	75,000	Substations, 1 power station, transmission and distribution systems
Gas	7,000	Blast	Prod. 100 percent; system, 20 percent	200,000	Holders, producers, mains
Water	11,000	do	Prod., 20 percent; system, 20 percent	50,000	Mains, station venturi meters
Communications	10,000	Blast and fire	40 percent	75,000	Open wires and aerial cables, telephone apparatus
Transportation	15,000	do	St. Ry., 50 percent; R. R., 20 percent	St. Ry., 200,000; R. R., 100,000	Track, bridges, overhead wire standards, and stations

III. GENERAL INFORMATION

1. The survey was conducted by members of P. D. D. Team 2 during the period 13 October-30 November 1945 by:

Maj. Robert T. Marshall—electrical engineer (electric power).

Capt. Arne E. Fessel—mechanical engineer (gas, water, transportation, telephone, and telegraph).

2. Personnel interviewed consisted of plant managers, chief engineers, section chiefs, and specialists. Besides these, many workers present at the time of the detonation of the atomic bomb were interrogated. Company plans and records were used, as well as plans and diagrams prepared by team members on inspections of the plants. Officials from the same companies often gave conflicting information, which made the work for the team members difficult. Due to this condition, the most logical conclusions have been presented in this report.

3. The actual damage analysis is preceded by a brief description of the evolution of the individual utility companies and their importance to the life of the city.

4. This report describes in detail the damage to:
Electric power system.
Gas supply system.
Water supply system.
Telegraph and telephone system.
Street railway.
Railroad.

5. Wherever necessary, photographs, drawings, and diagrams have been presented to supplement the text.

6. The city was attacked with conventional-type high-explosive bombs prior to the atomic-bomb attack. Damage to public utilities by these attacks was very slight, and was readily identified and isolated from the atomic-bomb damage.

No detailed survey was made of HE bomb damage.

The causes of damage considered in this report are:
a. Blast.—Damage by direct impact of oblique or normal air pressures produced by the bomb.
b. Debris.—Damage by collapsing and falling of the structures.
c. Fire.—Damage caused by direct contact with burning debris.
d. Weather.—Damage by exposure to the elements.

The terms used to describe equipment damage are:
Total damage.—Damaged beyond repair.
Heavy damage.—Requiring repair beyond capacity of normal maintenance staff.
Slight damage.—Requiring repair within capacity of normal maintenance staff.

Abbreviations of certain terms which appear in this report are:

IV. UTILITY DAMAGE ANALYSIS

Nagasaki Electric Distribution Co., Ltd.

The district of Nagasaki was served by the Nagasaki Electric Distribution Co., Ltd., which was a privately owned organization. The transmission lines and transformer stations were of modern construction and well planned for continuity of service. There were three main generating stations connected to the transmission network. Two of these were steam operated, government-owned, and the other was a privately owned hydroelectric plant. One steam plant of 100,000-kilowatt capacity was located at Ainoura and the other of 108,000-kilowatt capacity was located at Omura. The hydroelectric plant of 10,000-kilowatt capacity was located at Kawakamizawa. There were several other hydroelectric stations at greater distances from the city for which no data were obtained. Each of these stations was connected to the Takeo switch station by two high-tension transmission lines. There were four 66-kilovolt circuits from Takeo station to the Nagasaki switch station. The latter was the main high-tension switch station for the Nagasaki area. There were six circuits from the switch station to the various local transmission distribution stations. A 3,000-kilowatt steam electric generating station was located approximately in the center of the city industrial area. This plant was inefficient and was used for emergency stand-by service only.

in this report are:

a. Zero hour or ZH.—The time of the explosion of the atomic bomb, 1,102 hours, 9 August 1945.
b. Air zero or AZ.—The point in the air where the bomb exploded, 1,700 feet above ground level.
c. Ground zero or GZ.—The point on the ground vertically below the point of detonation of the atomic bomb.

10. Repair time in man-hours has been estimated in most cases in consultation with Japanese plant officials. The amount of skilled repair work produced in one Japanese man-hour is considerably less than that in the United States. Accurate determination of the ratio between an American and a Japanese man-hour is rather problematical. From observation, however, a fair ratio was estimated to be approximately five to one for skilled repair work.

b. The rationing and allocation of electric power was placed under Government control in April 1944 because of the shortage of water for the hydroelectric stations and the increased demand for power by war industries. This control group met approximately every 10 days to allocate power to the different customers. A reduction in the allocation was accomplished by a complete work stoppage for short intervals each day in the industry affected.

c. Eight transformer stations and two switch stations were in the area with a total rated capacity of 96,000 kilovolt-amperes, including spare transformers. The Takenokubo station was the only station with a spare transformer. All power transformers were connected delta-delta, or open delta, 66,000/3,500 volts. The total connected transformer capacity available was 77,430 kilovolt-amperes. The smaller transformers were also connected delta-delta with one line of the secondary circuit grounded. Figure 1 indicates the location of transformer substations and route of high-tension lines. Figure 2 is a one-line circuit diagram of the electrical system from the Takeo switch station to the transformer stations in the area. Figure 3 is a circuit diagram that includes the transformer, switch and generating stations. The city of Nagasaki was totally without electric power for a period of 2 days (9 and 10 August 1945). Distribution lines were restored and temporary service was made available, as shown in Figure 4,

on 11 August 1945. Figure 5 shows the electric 3.5-kilovolt distribution system prior to the attack, the damaged portion and the temporary lines constructed. Figure 6 is the distribution system that was in service on 21 October 1945. The company served 40,842 residential and

The company served 40,842 residential and 949 industrial customers prior to the attack. Immediately after the attack these figures were 7,000 residential and 350 industrial, and as of 1 November 1945 there were 23,459 residential and 409 industrial customers. Table 1 lists the quantity of different types of power consumption in the city for the years 1940-45. Table 2 lists kilowatt-hours load on each transformer station for the year 1945.

c. Table 3 lists the damage to the distribution circuits from the various transformer stations, showing the length of circuit, amount destroyed and repaired; the number of transformers and total capacity; the number destroyed and capacity thereof. The estimated number of man-days (10-hour days) to reconstruct the distribution system was 5,794.

f. The damage to the 66-kilovolt transmission system is shown in Table 4. A total of approximately 3½ miles of transmission line was damaged of which 1.7 miles had been repaired as of 1 November 1945. There was a total of 10.7 miles of transmission lines, not including the lines to Egawa and Ioshima stations which sustained no damage. Seventy-six steel towers and 30 concrete poles on the lines were damaged, and 8 towers and 4 concrete poles were destroyed. Figure 7 indicates the damage to the lines to Mukoshima and Zenza substation from Nagasaki switch station.

g. Figure 8 is a drawing of one of the towers damaged on the Mukoshima line, Takenokubo station tap, three towers from the station. This damaged tower is also shown in Photo 1. Tower 24 on the Mukoshima line was similar. Figure 8A is a diagram of Tower 23.

h. The damage caused by the atomic bomb to the transformer stations was comparatively small. Only three of the transformer stations, one distribution switch station, and the local generating station were damaged. The generating station building was damaged, but with only minor damage to the turbo-generator and boilers. The Takenobu station sustained heavy damage to the bus structure, steel rack, and switch building, but there was no damage to the heavy equipment.

The control house was destroyed and the insulators broken at the Urakami station. The building that housed the 3,500-volt, oil circuit breakers and bus structure at Zenza station was damaged to such an extent that a temporary building had to be erected. There was only minor damage to the Akunoura station. Table 5 lists stations and shows transformer capacity and damage.

i. *Generating station.*—The steam-electric generating station was housed in a brick building with a wood roof, combination wood and steel trusses, brick walls and columns, and reinforced concrete floors and foundation (Fig. 9 and photos 2, 3, 4, 5, 6, and 8). This station was located approximately 6,700 feet southwest of GZ. The building was damaged by blast. It contained three small boilers and one cycle Parsons turbo-generator and auxiliary equipment. There was only minor damage to the boilers and weather damage to the turbo-generator and auxiliary equipment. The switchboard, control, and bus structure in the east end of the turbine room were heavily damaged by blast and debris (Photos 3, 4, 5, 6, and 8). The foundation had been prepared for the installation of an additional turbo-generator. (Fig. 10 is one-line diagram of 3,500-volt bus and circuits.)

j. Zenza substation.—This station was located between two hills approximately 5,400 feet south of GZ. There were two banks of transformers, each consisting of three 3,000-kilovolt-ampere 64/3.5-kilovolt transformers for a total capacity of 18,000 kilovolt-amperes. Two 60-kilovolt circuits to this station were connected to the high-voltage bus through modern oil circuit breakers. A 3,000-kilovolt-ampere synchronous condenser was connected to the 3,500-volt bus and also seven feeders with 100-kilovolt-ampere voltage regulators. They were used in an effort to maintain a steady voltage on the distribution circuits. This station primarily furnished electricity for residential use and to the motor generator station for the street railway system. A one-line circuit diagram is shown in Figure 11.

k. The only blast protection for the high-voltage breakers was furnished by the natural surroundings (Photo 7). The transformer and low-voltage breakers for the transformers were protected by blast walls on three sides and by a hill on the

These walls with the exception of the transformer banks were made of wood filled with earth. They were 5 feet wide at the base, 3 feet wide at the top, and 15 feet high. The tops of the blast walls were at the elevation of the transformer high-voltage bushings. Between the transformer banks was a wooden wall filled with earth, 30 inches wide and 16 inches thick at the top, were reinforced-concrete walls, 16 inches thick at the top, were 10 inches thick at the top, were in the same bank (Photo 9). No damage to equipment in the transformer yard.

The control and low-voltage switch building, which was a modern, fully automatic, unattended building, had a steel truss roof, concrete floor, brick walls, columns and brick foundation (Fig. 12). The building was damaged to such an extent that the temporary building had to be erected to house the equipment before service was restored (Photo 10). With the exception of damage to 3.5-kV bus and control cables there was very little damage to the bus and control cables (Photos 11 and 12).

the equipment damaged. This station was located on the west bank of the Urakami River approximately 3,600 feet southwest of GZ. There were two banks of transformers, each consisting of three 5,000-kilovolt-ampere, 66/3.5-kilovolt transformers. There was one spare transformer for the two banks for a total capacity of 28,000 kilovolt-amperes. This substation was the largest and most important one in the area. All of the electric power for the nearby industrial area was obtained from here. The residential load was very small. Two 66-kilovolt circuits on the same steel towers were connected to the high-voltage lines through modern oil circuit breakers. A 7,500-kilovolt-ampere synchronous condenser was installed at this station for voltage regulation. A one-line circuit diagram is shown in Figure 13. Attention is called to the unusual switching arrangement for the spare transformer which could be used to replace, with a minimum of time delay, either of the other transformers in case of damage. The damage to this station was much greater than that to any other station. Figure 14 is a plan layout for building and switch yard.

The reinforced-concrete control and low-voltage switch building had the end of its north wall blown in on the second floor (Photos 13, 14, and 15). The damage to the equipment within

the building was minor, consisting mainly of damaged instruments and switchboards (Photo 16). The damage to the outside equipment with the exception of the steel rack was light, consisting of broken insulators and distorted buses. The transformers and oil circuit breakers were protected by wood-constructed, earth-filled, concrete blast walls, similar to those described for Zenza substation. The blast wall on the north side of the transformer was blown over (Photo 17). The wooden blast wall, separating the transformer bays from the high-voltage, oil circuit breakers, was blown over for about two-thirds of its length. The steel tower shown in Photo 18 was in the center of the wall, and was pushed out of line 4 feet as indicated. The entire steel rack for transformers and switches was shifted away from the blast for a distance of 4 to 8 feet, the towers bending at varying distances from the ground depending on the structure. The position of the disconnect switch and the distorted tower located within the concrete blast walls, shown in Photo 19, is a good indication of the distance the rack was shifted. The disconnect switch was originally directly above the high-voltage bushing on the right. Other views of the distortion of the rack are shown in Photos 20 and 21. The distortion of the nearest line tower to the station is shown in Photo 22. The main members of the steel rack were constructed of angles 2½ by 2½ by ¼ inch with the cross-brace angles 1½ by 1½ by ¼ inch.

o. The damage to the low-voltage, outside bus structure and switch rack located east and north of the control buildings was almost complete. Three copper bus feeders, mounted on insulators and angle-iron rack on wooden poles, as shown in Photo 23, were blown over and distorted. Evidence of flash burns can be seen on the wooden poles. Photos 24 and 25 are views of the 2.5-kilovolt switch rack showing the distortion of the main rack members.

p. The damage to this station was so great that the entire steel rack structure will have to be dismantled and rebuilt. This station was lo-

g. *Urakami substation*.—This station was located 5,200 feet northeast of GZ, near the Mitsubishi Urakami ordnance plant. There were two 66-kilovolt circuits on steel towers connected to one bank of three 3,500-kilovolt-amperes, 66/3.45-kilovolt transformers. The total capacity of the station was 10,500 kilovolt-amperes. With the ex-

ception of a few distribution circuits to the nearby residential section, the entire output of this station was for the ordnance plant. There was a bank of three 200-kilovolt-ampere 3.3/6.6-kilovolt step-up transformers on one circuit. Figures 15 and 16 are one-line circuit diagram and station lay-out, respectively.

r. The transformer bank was protected on the south and east sides by wood-constructed blast walls, 5 feet wide at the bottom, 3 feet at the top and as high as the top of the bushings on the high-voltage side of the transformers. This wall was filled with earth, and the side adjacent to the transformers was protected by a reinforced-concrete slab. Concrete walls, 12 inches thick at the bottom, 8 inches thick at the top, and rising to the height of the top of the high-voltage bushings on the transformers, were on the other two sides of the transformer bank and between the transformers (Photos 26, 27, 28). The damage to outside equipment was light, consisting only of broken insulators and bushings.

s. The control building which housed the switchboard and all electrical controls was a small wooden structure that was completely demolished. All switchboards and controls were damaged (Photo 29).

t. *Akunoura substation.*—This station was located on a hill 10,500 feet southwest of GZ. It sustained only minor damage as shown in Photo 30.

u. The transformers had been moved from this station early in 1945, due to its vulnerability to air attacks, and were to be installed at a new location near the shipyards. A 7,500-kilovolt-ampere, 3.5-kilovolt synchronous condenser was installed here for voltage regulation; the station was used only as a 3.5-kilovolt switch station. Photo 31 shows steel rack and circuit entrance to the building. Photo 32 shows the outside 3.5-kilovolt switch rack.

r. The high-voltage section of the station was used only for a sectionalizing breaker in the high-tension lines to and from the station. Photo 33 is a general view of that part of the station.

w. *Mukoshima station.*—This station was located 12,500 feet southwest of GZ, and was placed in operation in June 1945. It was originally planned to have four 4,000-kilovolt-ampere, single-phase transformers installed here, but due to lack of time only two were installed. These transformers had formerly been at the Akunoura station. This station was installed in a road

tunnel with the nearest transformers 35 feet from the south entrance. All switch gear and control equipment were located farther back in the tunnel. Photo 34 is a general view of the tunnel entrance. Both the high- and low-voltage circuits entered the tunnel through the high-voltage bus structure. Photos 35 and 36 are inside views showing the 3.5-kilovolt switchgear, cables and busses. There was no damage to this station.

z. *Tategami station.*—This station was located 15,000 feet southwest of GZ and received no damage. Located here were three 4,000-kilovolt-ampere 64/3.5-kilovolt single-phase transformers protected on three sides and between transformers by 12-inch concrete walls the height of the high-voltage bushings on the transformers (Photo 37). The north side was protected by a nearby hill.

y. Plans had been made for, and construction had been started on, a tunnel in order to place the station underground, like the Mukoshima station. Photo 39 is a view of the tunnel entrance and Photo 40 shows the location of the present station with respect to the tunnel. Photo 41 shows the 3.5-kilovolt switch rack and circuits leaving the switch building.

z. *Egawa station.*—This station was located 30,000 feet south of GZ. There were two banks of two 1,000-kilovolt-ampere transformers connected open delta, with sufficient switches installed to change to one bank connected delta with a spare transformer—a very unusual switching arrangement. The transformers were protected by the usual wooden, earth-filled, blast walls. Photos 42 and 43 are general views of the station. It was not damaged.

aa. The total damage to the utility system was estimated to be 152,400 yen. The estimated man-days (10 hours per day) to complete repairs to the entire system was 7,500.

2. Gas Supply System

The Western Gas Co., Ltd., was founded in 1902 for the purpose of supplying gas to the population of Nagasaki. With the rapid expansion of the Mitsubishi Industries and the development of the city, the original producer plant located at Yachiyo Machi was frequently enlarged. The principal company was later amalgamated with the Northern Kyushu Gas Co. of Fukuoka, capitalized at 15,000,000 yen, and a new gas-producing plant under construction at Ohashi was scheduled for completion by October 1945.

August 1945 only the gas holder was in use. Layouts of the two gas-producer plants are shown on Figures 17-17A and the city distribution system on Figure 18. The average monthly production figures for the Yachiyo Machi plant were:

Gas (cubic feet)	17,653,140
Coal (tons)	696,414
Coal tar (tons)	38.5

The gas company served 9,049 city consumers who accounted for 34 percent of the total production, while the major industrial plants accounted for the remaining 66 percent as follows:

	Percent
Mitsubishi Shipyard	14
Mitsubishi Turbine Works	37.5
Mitsubishi Electric Co.	6.1
Mitsubishi Steel Works	8.4

Prior to 9 August 1945, a few gas mains had been slightly damaged by high-explosive bombs in the attacks of early August 1945. This damage had not yet been repaired and, as a result, part of the city was without gas. The Yachiyo Machi plant had some surplus gas on 9 August 1945, which was distributed through a reserve pipe of 7.8-inch diameter to the gas holder at Ohashi, approximately 2 miles away.

Both gas-producing plants were of the conventional type, well organized and laid out. The retorts (Photos 54-56) were in the open air, covered only with tinplate roofing on a wooden structure. The main machinery was housed in flimsy wooden structures, but was in good condition. Capacities of holders are shown in Table 6.

The status of the gas holders at zero hour and initial positions of tank units are shown in Figure 19.

The tops of the two gas holders at the Yachiyo Machi plant were struck by the initial blast wave, presumably as indicated on figure 19, forcing the retort tanks off their supporting columns. The impact was also in excess of the shearing strength of the plates, resulting in failure at the riveted joints and deformation of the tank. No evidence of explosions was noted in either of these holders. Statements made by plant officials revealed that the gas escaped immediately without igniting or causing any damage. Details of the damaged holders are shown on Photos 45-52.

Damage to other equipment was slight. The roof covering the retorts was blown away with minor damage to the retorts themselves, which was evidenced by loosened brickwork, loose pipe connections, and broken retort doors (Photos 53,

54). The machine shed was collapsed by the blast without causing serious damage to the equipment. The station gas meter, however, was slightly damaged. Details and description of degree of damage sustained by equipment, time required for repair, and estimated cost thereof are summarized in Table 7.

h. The gas holder at Ohashi was approximately 80 percent full, and the tank units were consequently almost in top position as shown on Figure 19. It appeared that the tank had been struck by the downward components of the blast wave on one side somewhere near the top, forcing the guide rollers of the tank to be pushed off their tracks. This destroyed the waterseals and may have allowed the unusual atmospheric pressure caused by the blast to force air into the tank, thereby creating a dangerously inflammable mixture. That a low-order explosion took place was substantiated by the fact that parts of the holder were found 300 feet away in the direction of GZ. The structural damage was not typical of that normally caused by gas-holder explosions, but it may be that part of the gas contained in the holder escaped on the vacuum side away from the blast while the remainder exploded. Exact cause of the explosion could not be determined, but among possible causes were (1) heat generated in compression by blast, or (2) sparks emitted by friction between collapsing members of the tank's structure.

i. The holder was damaged almost beyond repair as shown on Photos 57-61. A summary of the superficial damage to the other equipment is shown in Table 8 (Photo 62).

j. Since the gas plants were unable to continue operation after zero hour, plant officials had no opportunity to ascertain the amount of damage to the gas mains. No excavation of these was made by the team members, but it is a logical assumption that they suffered damage near GZ equal to that sustained by water mains, since earth surface depressions were observed in this area.

k. Domestic installations in heavily damaged buildings were affected by the collapse of these structures. An accurate estimate of repair of these was not possible, but it was estimated by these plant officials that a minimum of 100,000 man-hours and a total expenditure of 200,000 yen would be required to complete repairs.

l. No definite evidence of fire caused by escaping gas was noted.

m. At the time of the survey the city was

without gas service and no attempt had yet been made to repair the gas holders or gas mains. Adequate arrangements had been made, however, to protect the other equipment against further damage by the elements.

3. Nagasaki Water Supply Co.

The water supply company was owned by the Nagasaki municipality, and represented a total investment of 15,000,000 yen. Water was obtained from four reservoirs, located in the hills surrounding the city, as shown on Figure 20. In effect, they represented four individual supply systems with arrangement for interconnections.

a. The oldest reservoir, completed in 1891, was of the earth-filled, gravity type, while the other two, constructed prior to 1925, were of concrete. These reservoirs were fed by springs and mountain streams, and their average height above sea level was 275 feet. The plant used a slow sand-filter system with three electric, centrifugal booster pumps which maintained pressure at high levels.

b. A new reservoir partly in use on 9 August 1945 was under construction on the Urakami River. This reservoir had modern-type rapid filters with three 120-horsepower electrically driven centrifugal pumps, used for pumping water from the filter beds through the clean water reservoirs. Technical data on reservoirs and filter-beds appear in Tables 9-12.

c. Water mains were of cast iron in 12-foot lengths of 10- to 28-inch diameter and were generally 3 feet below grade. Branch lines were in sizes ranging from 6½ to 10 inches in diameter. A static water pressure of 75 pounds per square inch was used in designing the system. The peak pressure recorded during the day was 45 pounds per square inch, but this dropped to about 30 pounds during maximum consumption periods which occurred at about 1130 and 1630 hours due to heavy industrial demand.

d. A series of failures was observed on a 12-inch main, 2,000 feet from GZ. The soil in which this main was imbedded was composed of layers of sand and earth over a layer of spalled rock of clay-like consistency some 20 feet below grade. The shearing strength of this pipe was, according to the chief engineer of the water company, 3,134 pounds per square inch and the static pressure was 45 pounds per square inch. These failures may be attributed to an uneven displacement of the soil caused by pressure from the blast wave,

since no evidence of damage from falling debris or other causes was discovered. Two typical points of failure on the 12-inch main are shown in Figure 21. Four breaks on other water mains were at bridge abutments within this same area. A total of 12 major breaks occurred on the main within a 2,500-foot radius of GZ. Some of these were attributed to soil displacements and others to shearing. Many breaks on branch and distribution pipes were caused by collapsing structures.

e. Slight damage by blast was sustained by the following equipment at the reservoirs:

(1) Station venturi meters (housed in wooden structures).

(2) Electric installation for pump equipment at Urakami (10,500 feet from GZ).

f. The water supply system, already taxed to the limit, was in no position to meet the demand for water necessitated by fire fighting. Within 24 hours, however, sufficient emergency repair was carried out to meet a part of the demand.

g. The repair time required to reestablish the system on a permanent basis was estimated to be 75,000 man-hours.

4. Telephone and Telegraph Systems

The telephone and telegraph systems were owned by the government and controlled by the same operating authority.

a. The telephone system was organized in 1896 with the installation of a single magneto-type switchboard. In 1902 parallel multiple-magneto switchboards were installed, and the system was considerably enlarged in 1927 when it was converted into a common battery system. Key-ring ringing was adopted for all subscriber switchboards in 1934.

b. Following is a list of toll lines from the Nagasaki main switchboard to other towns within the Nagasaki prefecture:

Town:	Circuits	Town:	Circuits
Sasebo.....	11	Shimabara.....	1
Isahaya.....	5	Fukue.....	1
Ohmura.....	2	Unzen.....	1
Narao.....	1	Nasahama.....	1
Yagami.....	2	Togitsu.....	1
Iojima.....	1	Nishinurakami.....	1
Seto.....	1	Kamitara.....	1
Matsushima.....	1	Fukuda.....	1
Mogi.....	1	Takashima.....	1
Hashima.....	1	Cuji.....	1
Fukohra.....	1	Nomo.....	1
Kabashima.....	1	Tameishi.....	1
Sakito Fukuura.....	1		

The number of toll lines to towns outside Nagasaki prefecture was as follows:

Circuits	Town:	Circuits
1	Fukuoka.....	9
2	Kokura.....	2
2	Saga.....	3
2	Hondo.....	1
1		

Figure 22 is a one-line diagram for both short and long-distance circuits. The damage to telegraph and telephone equipment, both inside and outside the prefecture, and the estimated time to repair are given in Table 13.

The central office of the telegraph system was located in the Umegasaki post-office building until July 1945. Because of the frequency of air attacks and damage to this building, it was decided by the management to move the office to a safer location in the educational building at Sakuraboa Machi, 10,000 feet from GZ. During the change-over a temporary central office was installed at Hoterujaya, 8,000 feet from GZ, an ordinary dwelling, with 20 of the main lines in operation. This installation was in use at the end of the survey, the end of the war having prevented the completion of the proposed move.

The business office was located in the building formerly occupied by the Great Northern Telephone Co. This company had been placed under control of the Japanese Government in 1940, and its telephone lines had not been in use since 1941.

There were 12 telegraph receiving offices in the city, 4 of which were directly connected to telegraph wires. The remainder were connected to the central office by telephone.

The type and destination of telegraph circuits within the prefecture of Nagasaki are shown in Table 14. The same information for circuits to points outside the prefecture and cable connections to foreign countries are shown on Table 15.

a. The physical damage to the telegraph system caused by the atomic bomb was slight as shown in Table 16. The operational damage was on the other hand, heavy. Out of a total of 64 lines, 49 were damaged which caused 77 percent of the system to be inoperative.

The open wire lines of both systems sustained heavy damage with slight damage to the remainder of the system. This was to be expected due to the vulnerability to blast.

j. Telegraph equipment and the damage sustained were as follows:

5. Nagasaki Street Railway System

This company was founded in 1914 with a capital of 500,000 yen and 10 employees. It steadily expanded to become a fair-sized, modern, public transportation system, adequately serving the population of Nagasaki.

a. The system was double track, with a rail gauge of 4 feet 8 inches (66-pound rails), and had an over-all length of about 6 miles. Fifty-six cars were owned by the company and 35 of these were in daily use, each traveling a distance of 118 miles. A daily average of 77,391 fares amounting to 5,859 yen was collected, and the average electric power consumption was 3,480 kilowatt-hours a day.

b. The sole source of electric power was a converter station located approximately 6,000 feet south of GZ. Primary voltage to the station was 3,300 volts, alternating current, which was stepped down and converted to 600 volts, direct current. The street cars were all single-track type, equipped with two 25-horsepower, 600-volt, direct-current motors. The converter station and its equipment were completely destroyed by blast.

c. The most serious track damage occurred within 2,000 feet of GZ where the track passed through a heavily built-up area. The houses in this area were typical Japanese dwellings of flimsy wooden construction, all of which were destroyed by blast and fire. Contact with burning debris from these houses caused many cross-ties to ignite, and the resulting fire distorted the rails. Rail distortions occurred intermittently and are shown in Figure 23. Photo 63 shows typical track damage.

d. The trolley wires were supported by steel standards as shown in photo 64 which was taken at a point 600 feet from GZ. The wires were displaced over most of the system and many standards were damaged. Photos 65-66 show view of damaged trolley wires and supports at approximately 1650 feet from GZ.

e. The terminal of the system was located 1,500 feet north of GZ where eight cars were located at the time of the explosion. All were totally damaged, three by fire and five by blast. Photo 67 shows a car approximately 300 feet from GZ.

Classification	Type	Number of systems	Damage (percent)	Man-hours to repair
Inside plant	Simplex system	26	0	
	Duplex system	12	0	
	Automatic system	10	0	
	Teleprinter	8	0	
	Carrier frequency	2	0	
	Motor-generator sets	2	0	
	Underground cable	*110,000	0	
Outside plant	Aerial cable	0	0	
	Open wire	*680,000	25	

*Feet.

f. Summary of damage to the system by fire and blast is as follows:

	Percent
39 cars within 10,000 feet of GZ	70
1.2 miles of track	5
270 rails distorted	3
5.9 miles of trolley wire	50
1.6 miles of feeder wire wrecked	50
4.6 miles of electric light wire	50
1 bridge	30

g. The entire system was completely inoperative at the time of the survey and 280,000 man-hours of repairs would have been required before full operation could have been resumed, as follows:

	Man-hours
Transformer and converter station	100,000
Tracks	80,000
Wiring	100,000

6. Nagasaki Railroads

Railroad facilities at Nagasaki consisted of a single line operated by the Imperial Government, running due north and connecting the city with the Tosu Junction. The line terminated at the Nagasaki station and served three other secondary stations within the city limits. Many passengers utilized this road as a means of transportation between the city and its suburbs. The table below furnishes some details regarding the number of passengers and the amount of freight handled by the Nagasaki railroad division prior to 9 August 1945, and also after emergency repairs had been carried out.

a. The 50-pound rails were secured to wooden sleepers in stone ballast. Rail gage was 3 feet 6 inches and tracks appeared to have been in good condition before the attack.

b. Damage sustained by the railroad system (summarized in Fig. 24) was severe enough to curtail traffic completely from 1115 hours 9 August to 2300 hours 12 August 1945. The most

Monthly traffic through Nagasaki main railroad station

Month	Passengers		Freight tonnage dispatched	Freight tonnage received
	Departed	Arrived		
July	186,018	182,953	17,013	23,500
August	194,349	187,110	14,437	18,700
September	98,625	98,184	504	1,400
October	102,882	121,800	1,408	2,500

serious damage was to the track and bridge. The wooden cross ties were burned and charred at intervals from a point 10,500 feet south of GZ to 12,000 feet north of GZ. The fire generated sufficient heat to displace the rails and cause them to buckle. Fires south of GZ could have been started by burning debris from the buildings in the area through which the rail line passed. In contrast, the track north of GZ passed through a sparsely built-up area where fires were light, yet many cross ties were burned here as well. It was probable that these fires were caused by the intense heat generated by the bomb explosion.

c. Three railroad bridges were displaced by the initial blast wave, thereby damaging the tracks. Bridges 8, 26, and 27 were of built-up, steel girder design, and had open cross ties but no solid decks. There was no evidence of fire on bridge 26 (Photo 68) and 27, but on Bridge 8 the cross ties were charred and required replacement. For further study of damage to bridges reference is made to Part 6 of this report.

d. The railroad communication system suffered considerable damage, within a radius of 12,000 feet from GZ, which was attributable to the blast which damaged many wooden telegraph and telephone standards and attached wires. Flash burns on poles were frequently observed but were seldom the cause of any serious damage.

Two interesting examples of blast effect were observed on the heavily damaged electric semaphore systems. Photos 70, 71 show three damaged signal blocks. On one of these blocks the signal plate was pressed in by the impact of the blast while one of the remaining two was over-

turned. The signal blocks were of quarter-inch steel plate, riveted to a heavy cast-iron frame which was, in turn, anchored to a concrete foundation with four 1/2-inch bolts.

f. Damage to the rolling stock which was within the city limits on 9 August 1945 was as follows:

Location	Type	Equipment present	Equipment damaged	Percentage
Nagasaki switchyard (8,000 feet south of GZ)	Locomotives	24	1	4
	Passenger cars	208	40	19
	Freight cars	350	75	21
Nagasaki station (4,000 feet south of GZ)	Locomotives	2	0	0
	Passenger and freight cars	18	18	100
Nagasaki station (12,000 feet north of GZ)	Locomotives	2	0	0
	Passenger and freight cars	36	6	16.6

It was estimated that 100,000 man-hours would have been required to repair all damage.

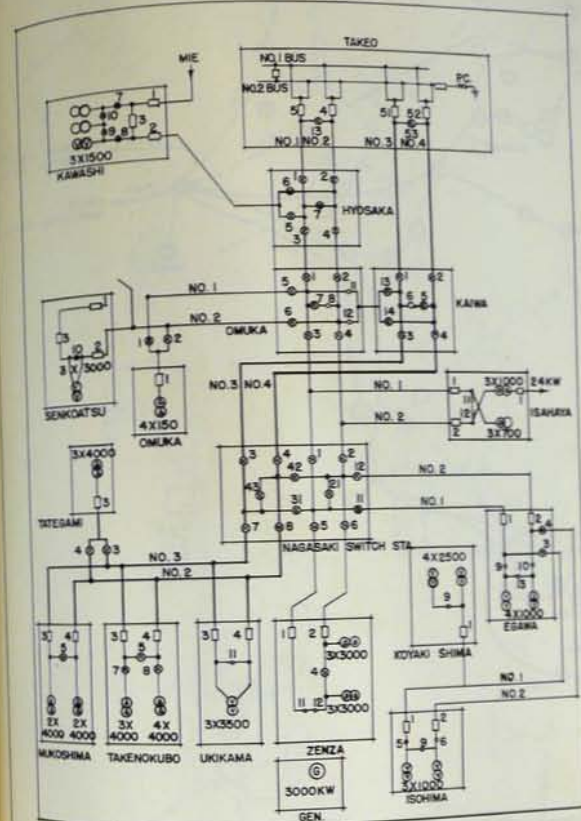
Protective Measures

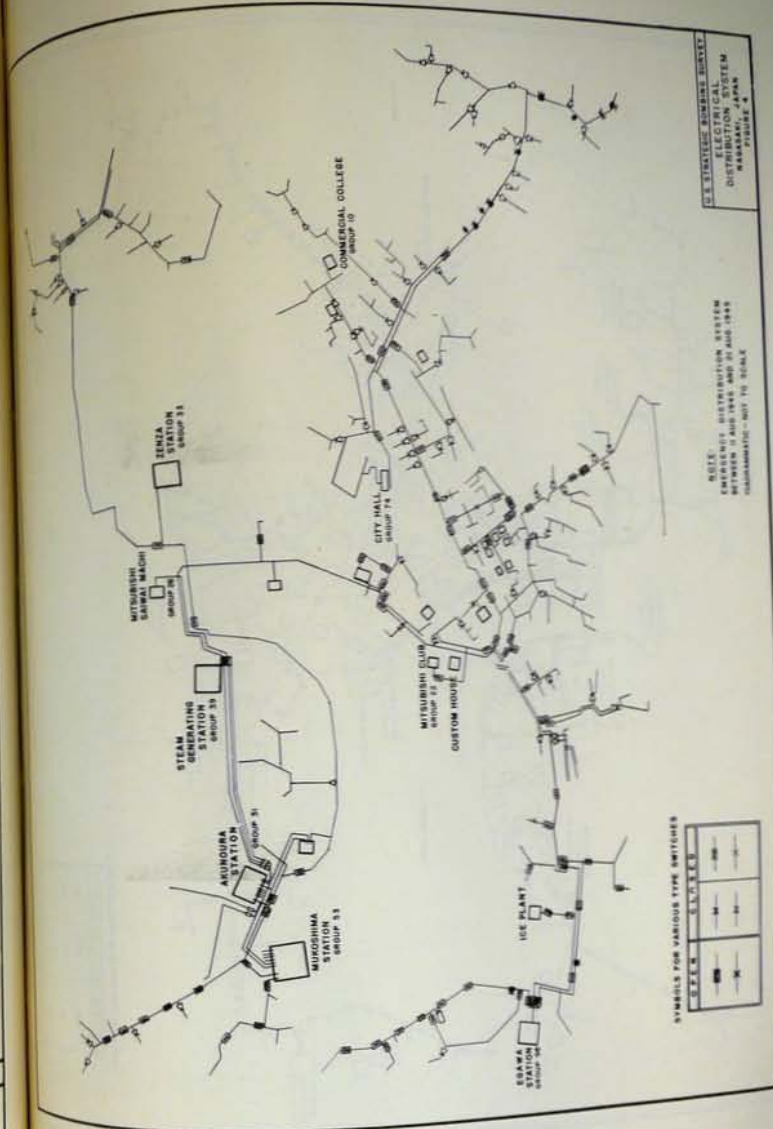
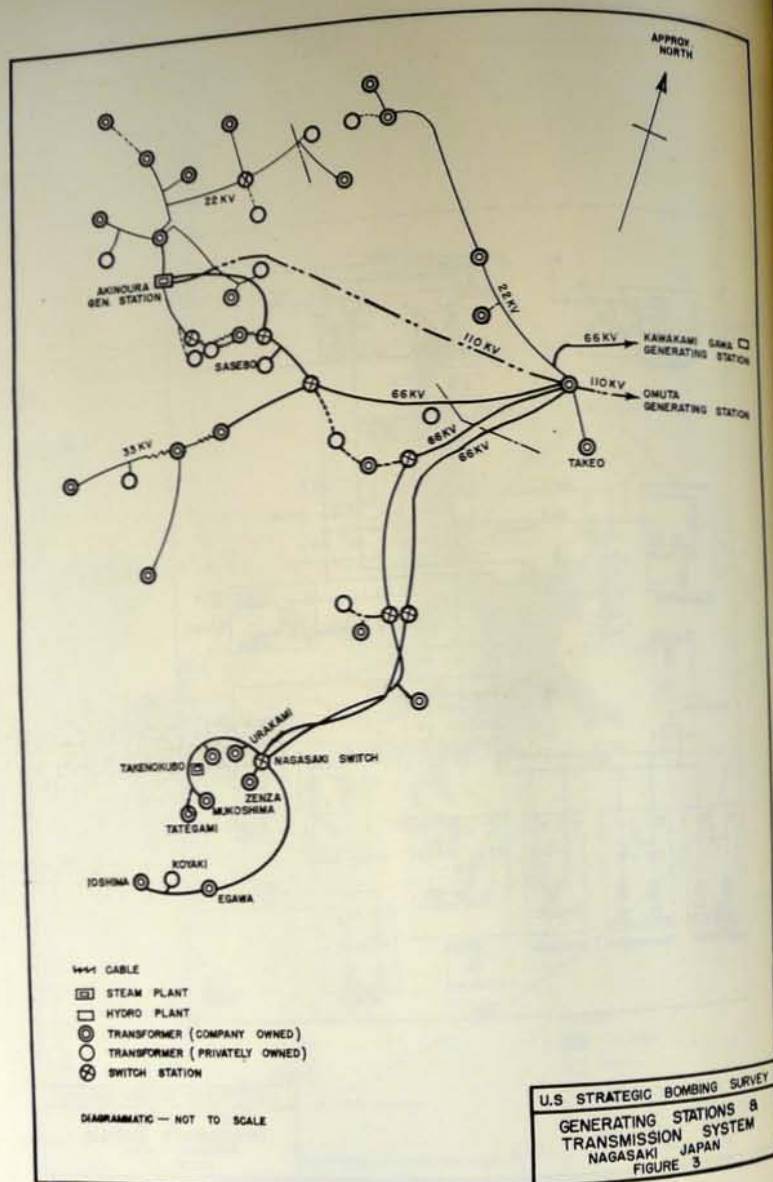
Considerable effort was made to protect electric equipment against air attacks. Concrete, and earth-filled wood blast walls were used extensively with good results. These types are shown in Photos 9, 17 to 20, 26, and 43.

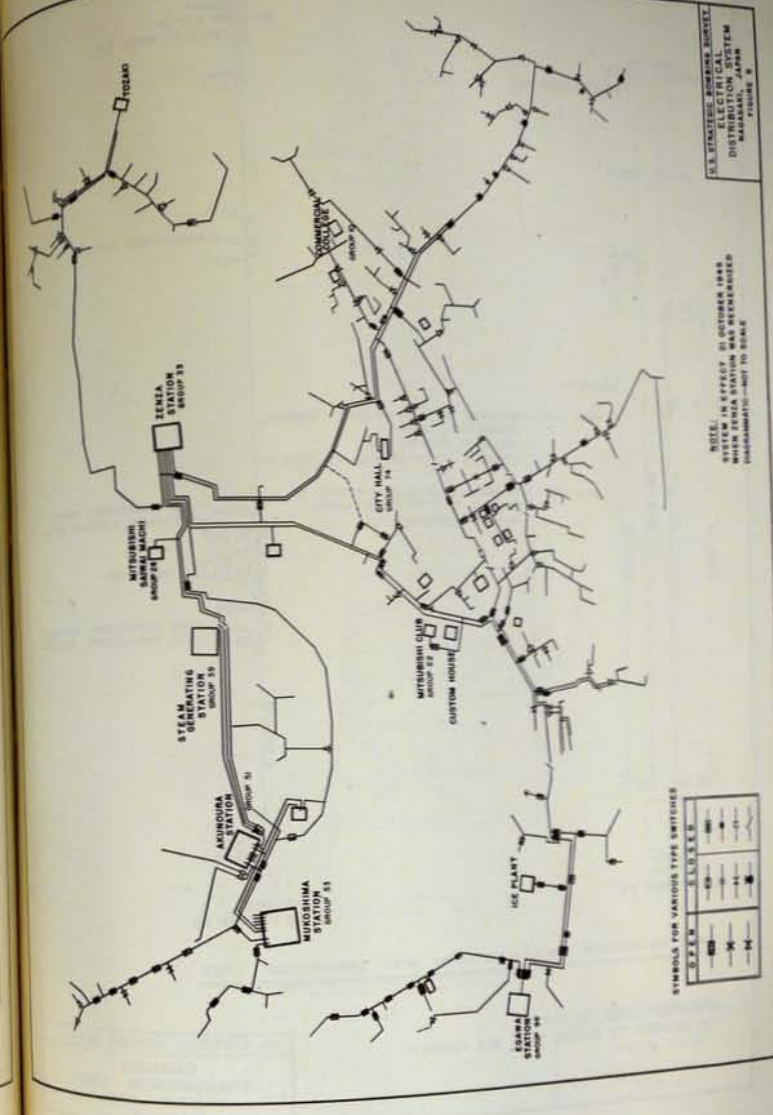
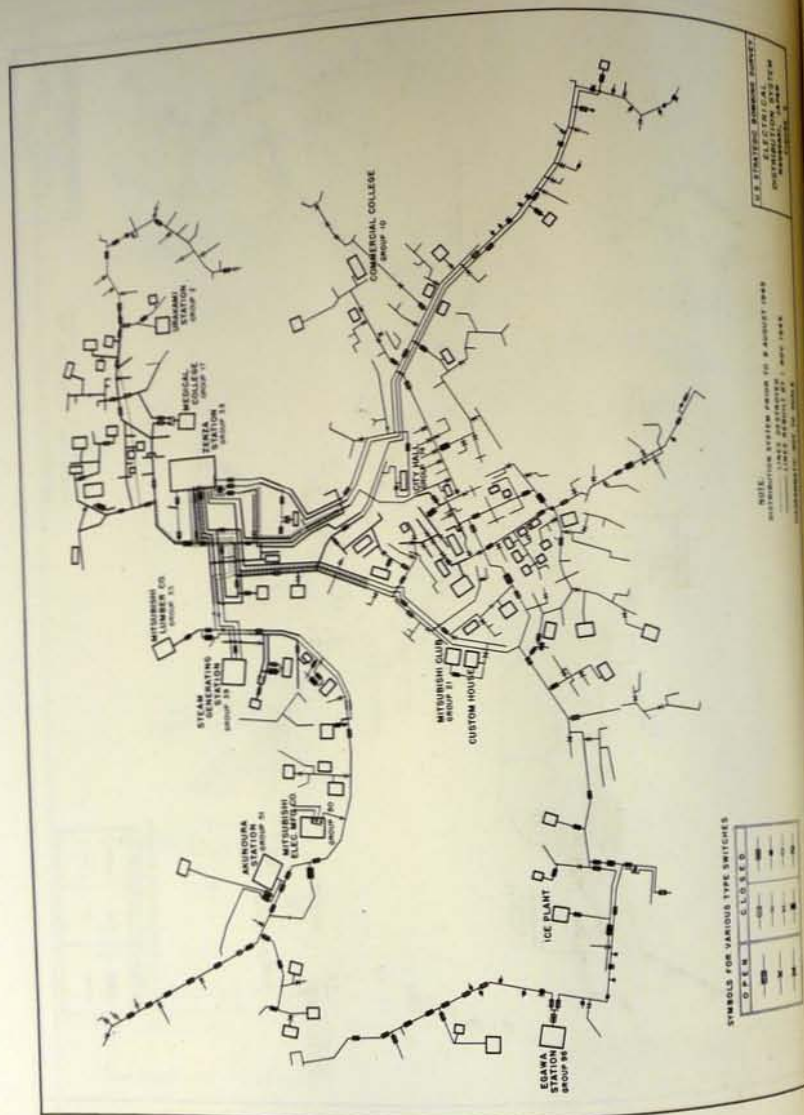
The more effective of the two types was the concrete wall which, in most cases, withstood the

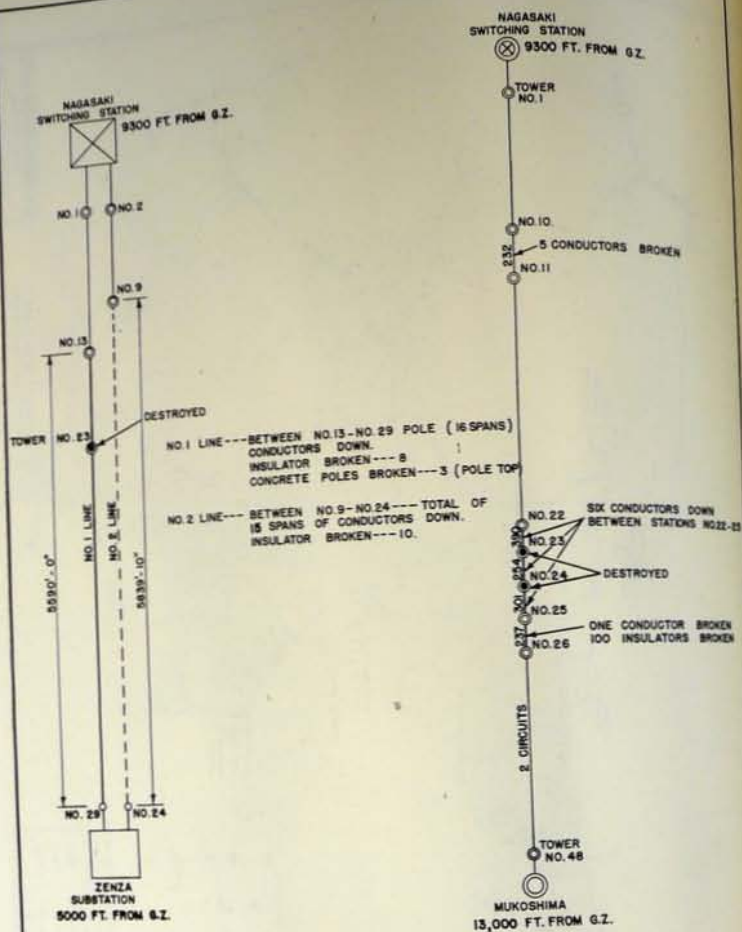
blast. In contrast, the earth-filled wood walls were in many cases totally damaged. It is worth noting, however, that even these walls did prevent serious damage to equipment.

f. As a further step to protect substations, concrete tunnels were under construction (Photos 35 and 39), into which the substations were to be installed. Some equipment had been removed from exposed sites and installed in these tunnels prior to ZH. No measures were taken to protect other utility plants.







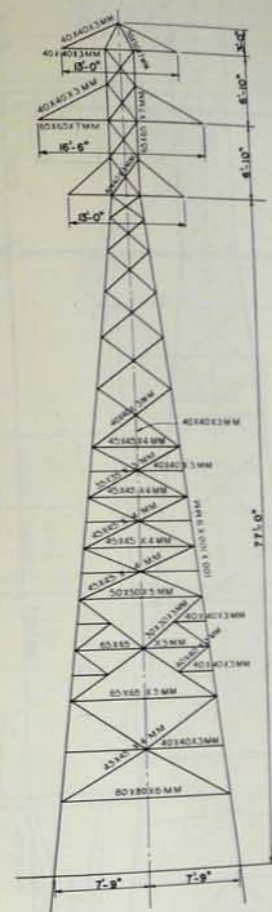


DAMAGE TO NAGASAKI SWITCH - MUKOSHIMA 66KV TRANSMISSION LINES

DIAGRAMMATIC - NOT TO SCALE.
FOR RELATION TO GROUND ZERO SEE FIGURE 1.

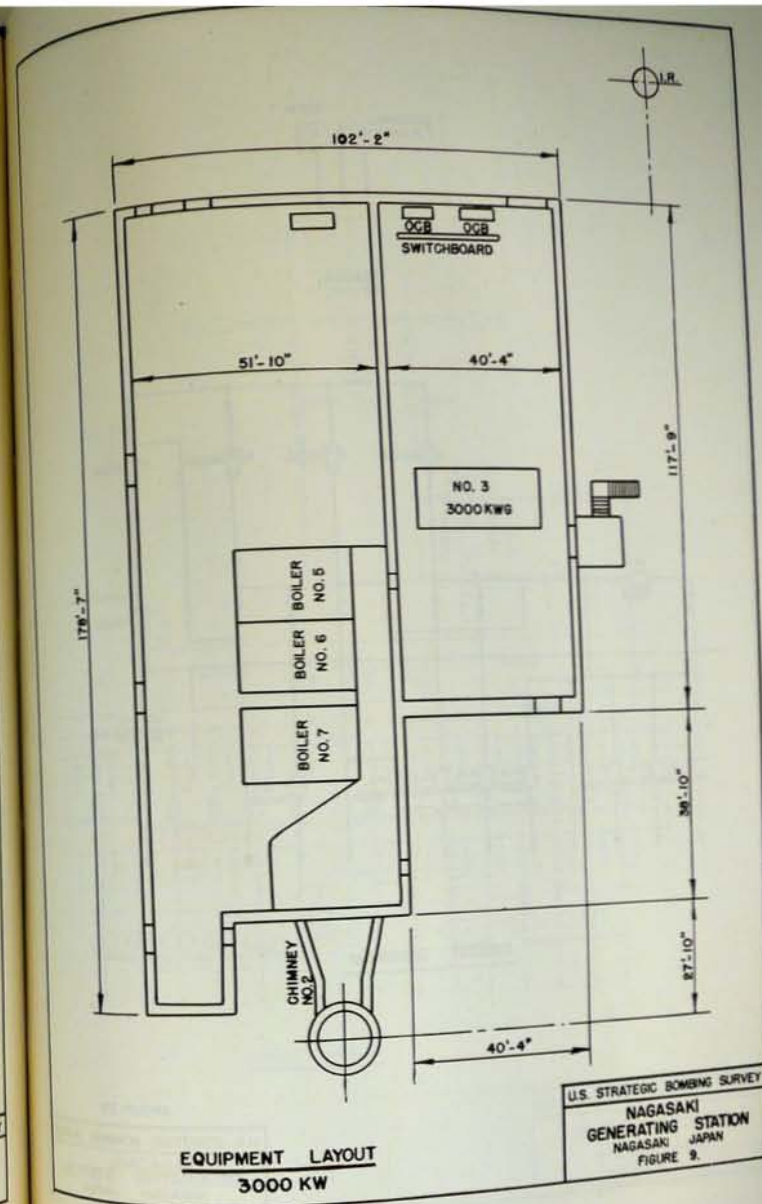
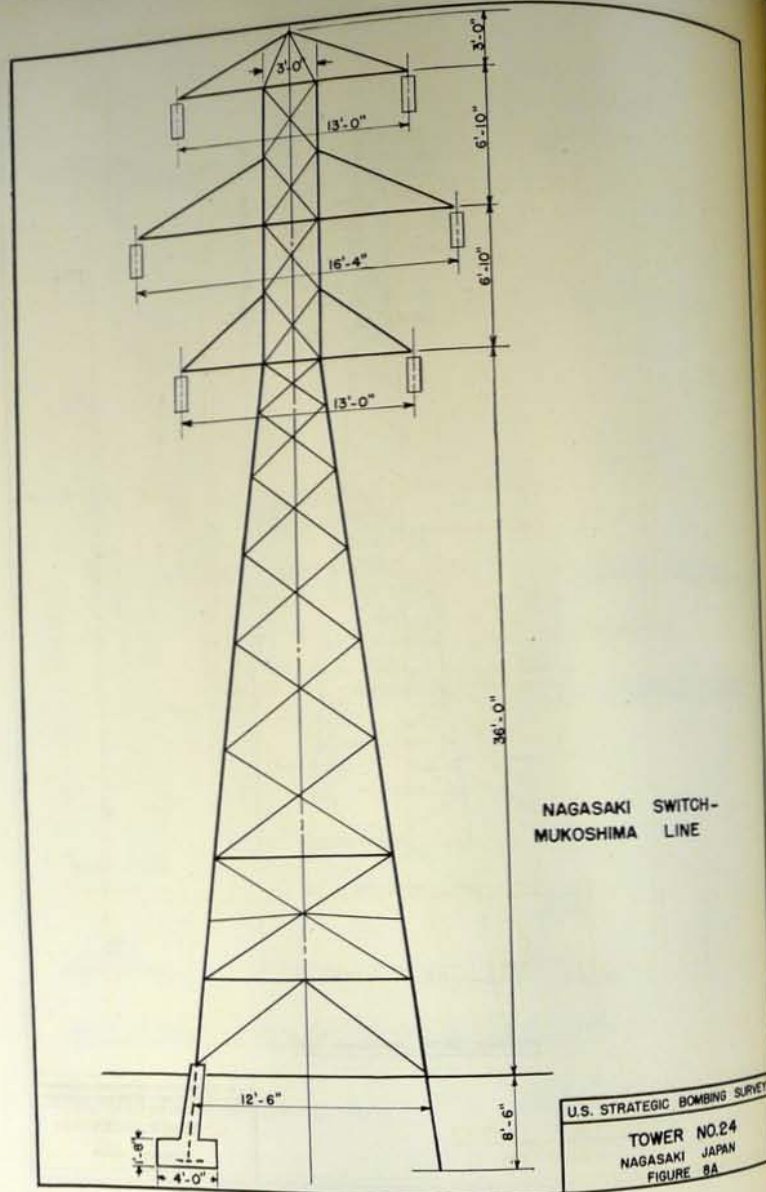
U.S. STRATEGIC BOMBING SURVEY

DAMAGED
TRANSMISSION LINES
NAGASAKI JAPAN
FIGURE 7.



U.S. STRATEGIC BOMBING SURVEY

TOWER NO.23
NAGASAKI JAPAN
FIGURE 8.

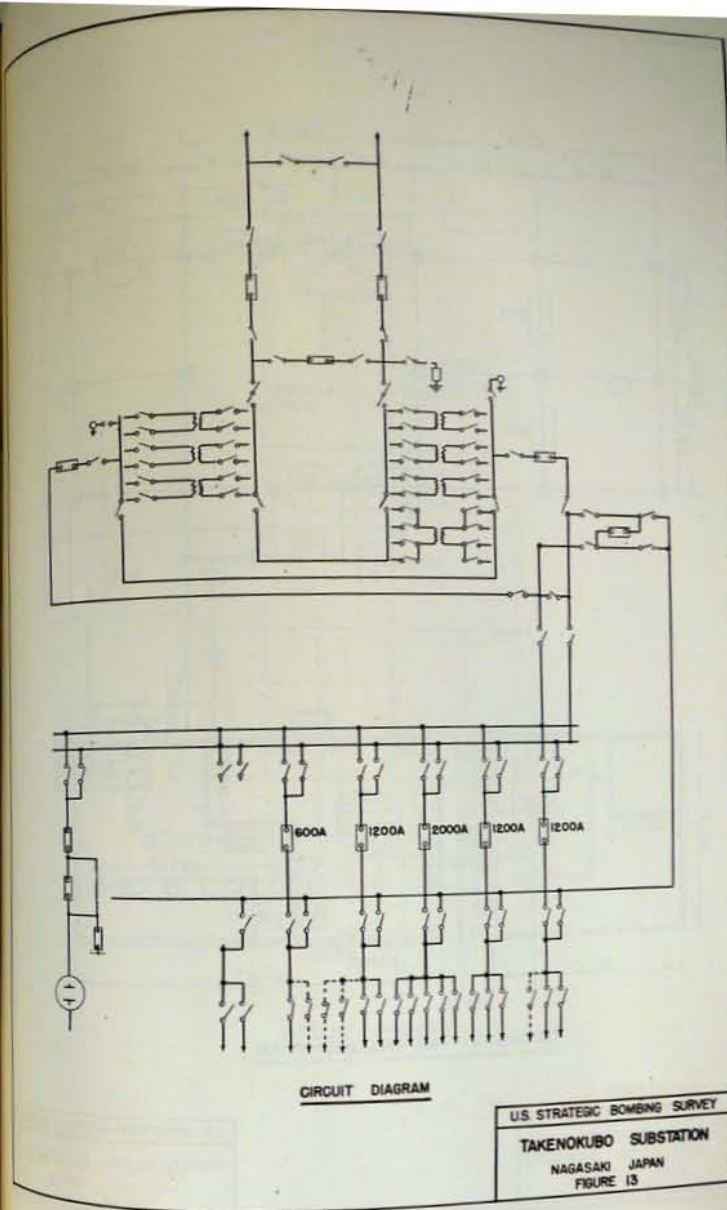
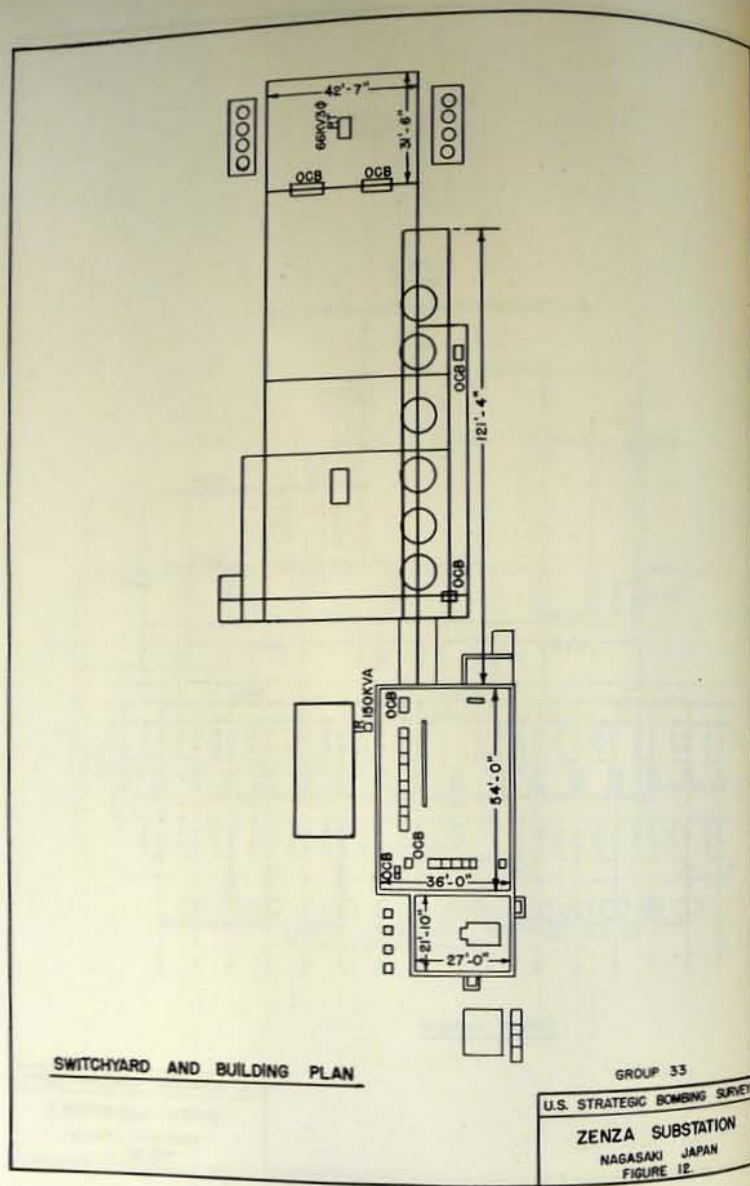




U.S. STRATEGIC BOMBING SURVEY
NAGASAKI
GENERATING STATION
NAGASAKI JAPAN
FIGURE 10

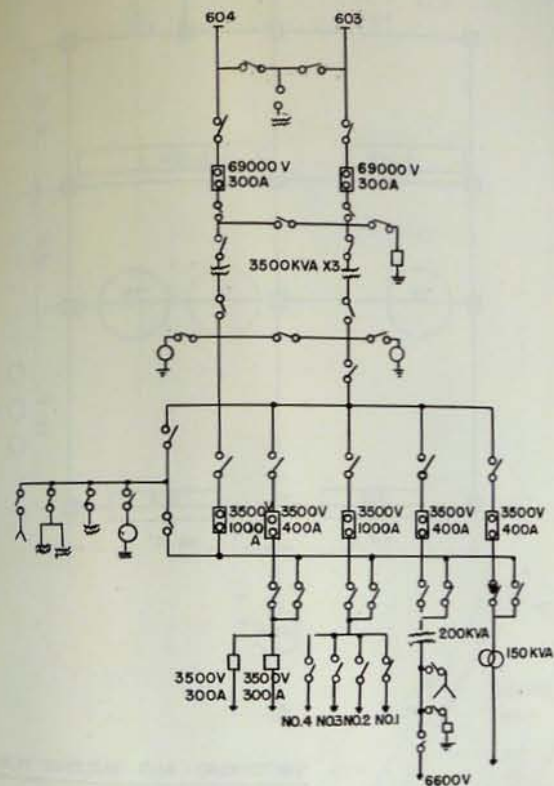
CIRCUIT DIAGRAM

U.S. STRATEGIC BOMBING SURVEY
ZENSA SUBSTATION
NAGASAKI JAPAN
FIGURE 11.



SWITCHYARD AND BUILDING PLAN

U.S. STRATEGIC BOMBING SURVEY
TAKENOKUBO SUBSTATION
NAGASAKI JAPAN
FIGURE 14.



CIRCUIT DIAGRAM

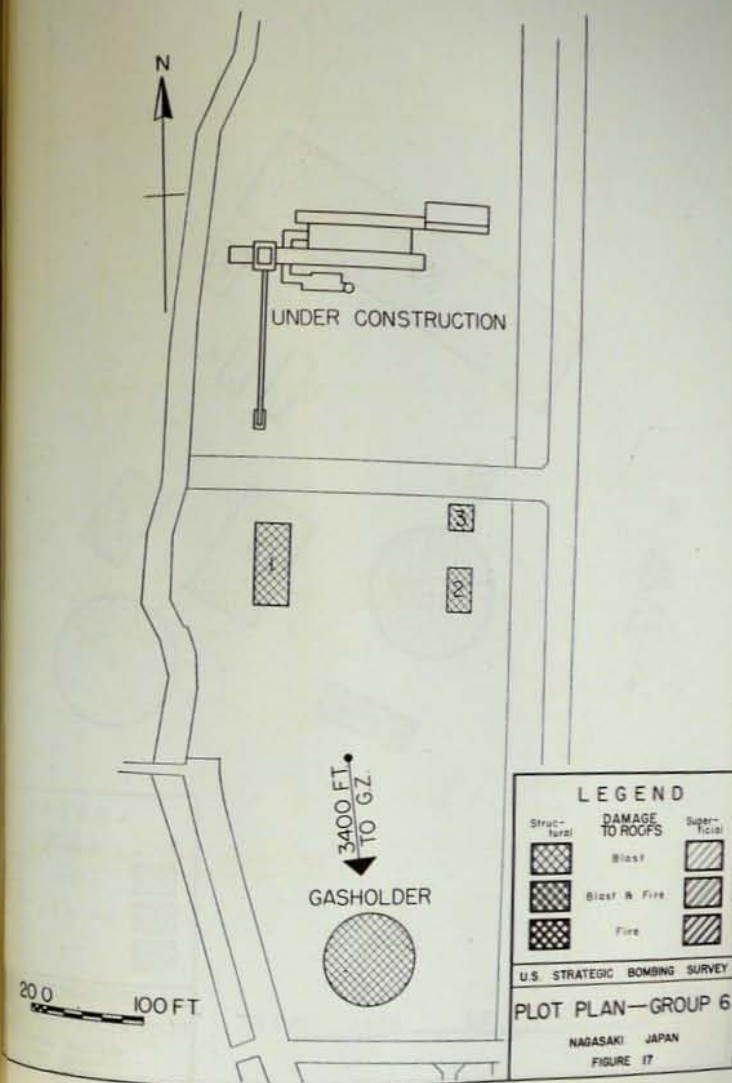
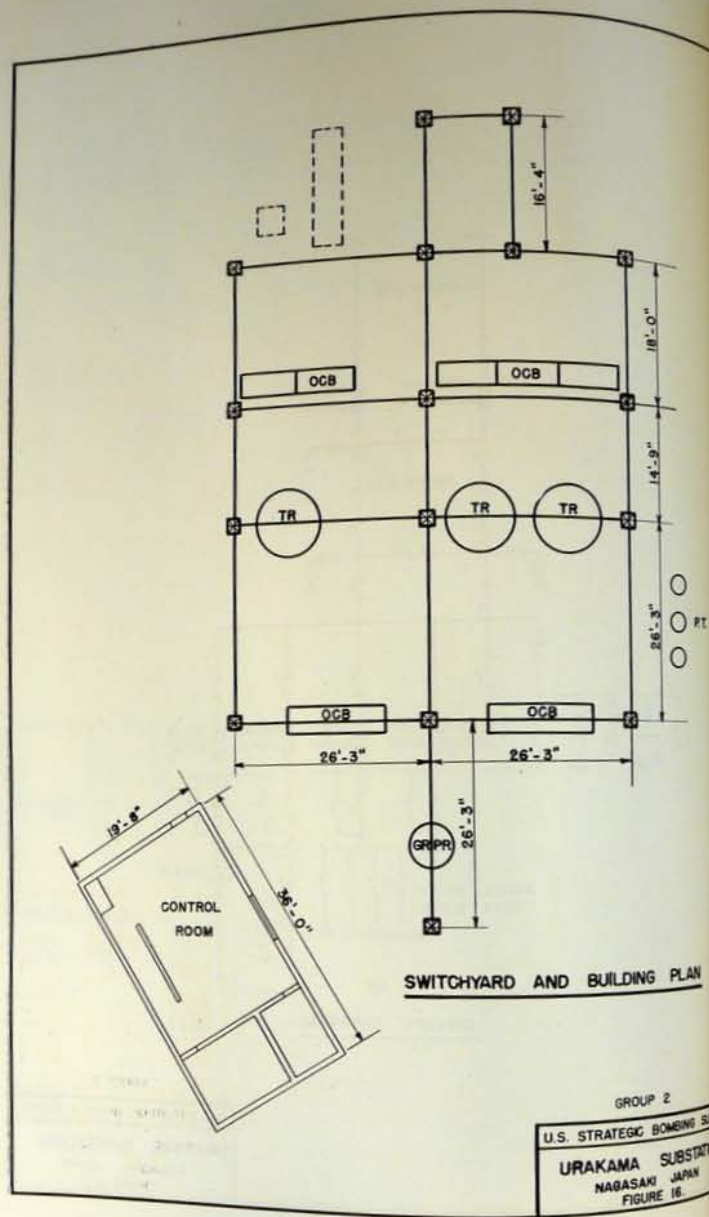
GROUP 2

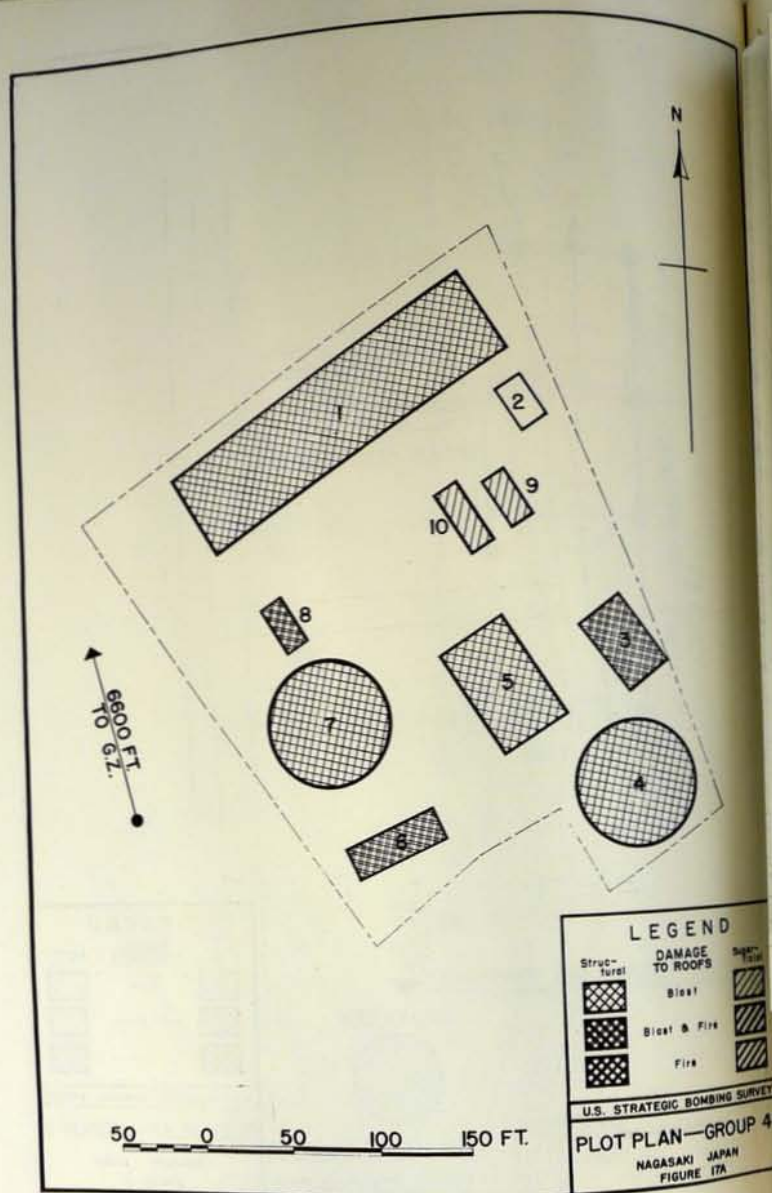
U.S. STRATEGIC BOMBING SURVEY

URAKAMI SUBSTATION

NAGASAKI JAPAN

FIGURE 15





APPROX. 100 FT.

APPROX. 100 FT.

APPROX. 100 FT.

GROUND ZERO

ON-BOARD GAS HOLDERS

APPROXIMATE GAS HOLDERS 1, 2

POINT

APPROX. 100 FT.

POSITION OF LINE AT
TIME OF EXPLOSION

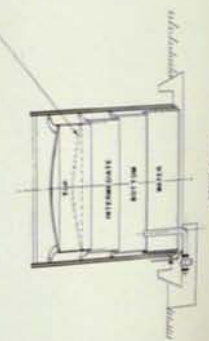


FIG. 1. ON-BOARD GAS HOLDERS

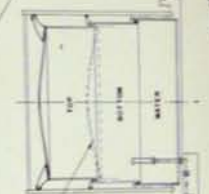


FIG. 3. ON-BOARD GAS HOLDERS

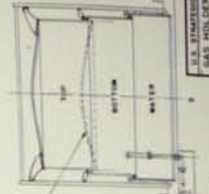
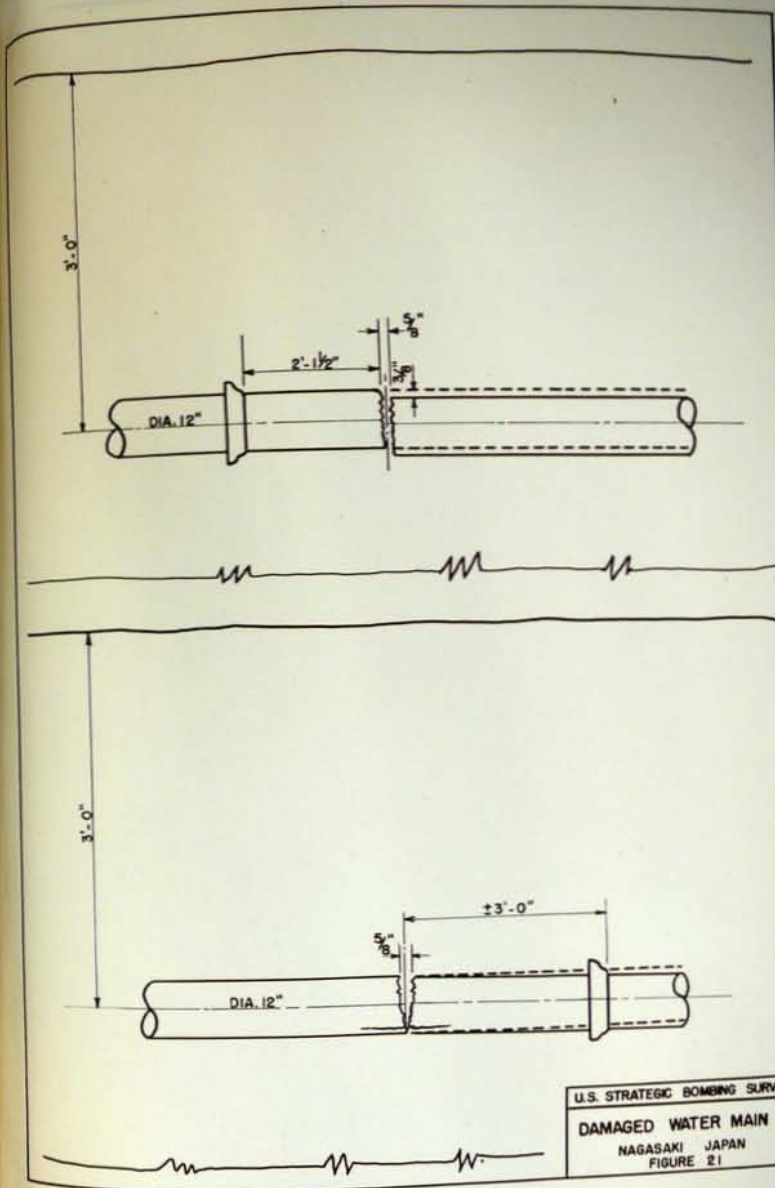
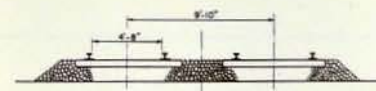
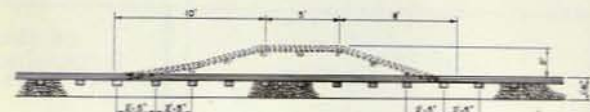
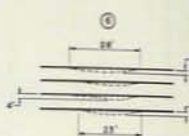
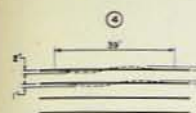
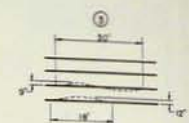
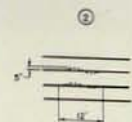
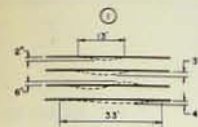
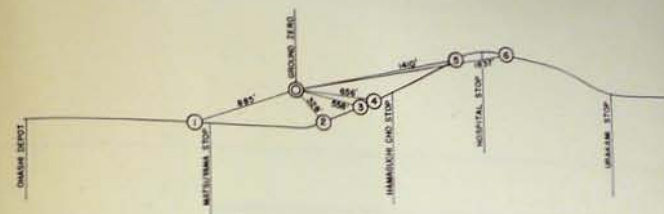


FIG. 5. ON-BOARD GAS HOLDERS

FIG. 6





U.S. STRATEGIC BOMBING SURVEY
DAMAGE TO
STREETCAR SYSTEM
NAGASAKI, JAPAN
FIGURE 23

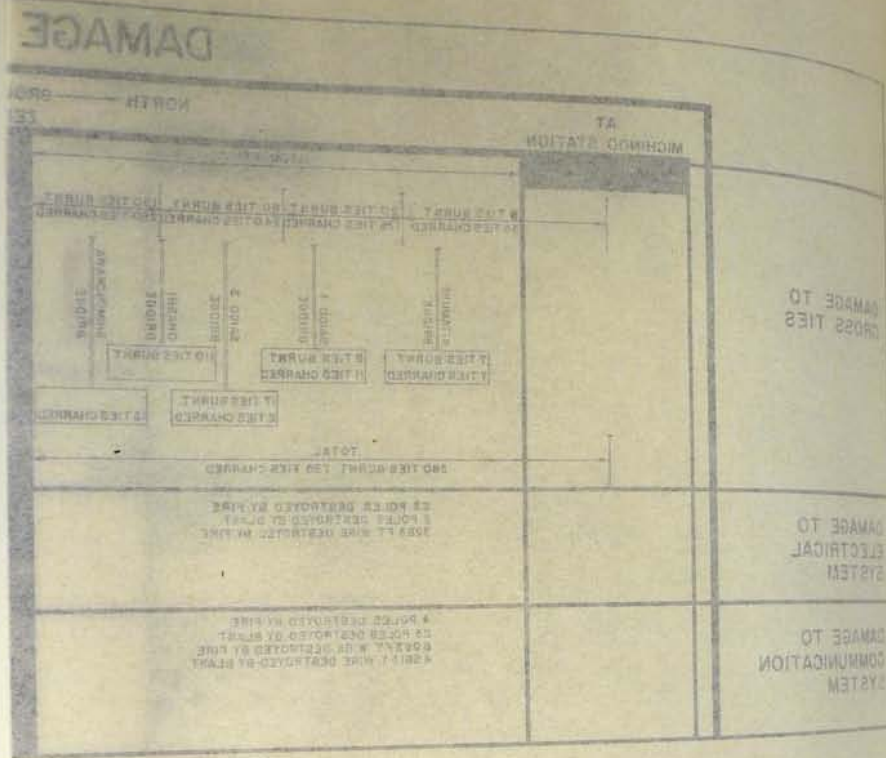


TABLE 1.—Electric energy kilowatt-hour consumption in city

Year and month	Private, 3-kilowatt and below	Industrial	Lighting	All others	Total	Capacity available, kilowatt-hours
1940	533,644	95,261,402	8,593,978	3,253,192	107,642,216	77,430
1941	693,494	94,890,487	8,623,025	2,583,970	106,790,976	77,430
1942	695,933	118,066,372	8,274,546	2,676,431	129,713,282	77,430
1943	634,842	113,458,848	6,920,356	2,157,864	123,171,910	77,430
1944:						
April	44,460	9,334,239	505,548	189,150	10,073,397	77,430
May	44,460	9,981,891	502,892	179,350	10,708,593	77,430
June	44,450	9,446,621	490,993	165,650	10,147,724	77,430
July	44,450	9,064,000	448,337	163,850	9,720,637	77,430
August	44,440	8,920,922	399,297	164,750	9,529,409	77,430
September	44,440	8,569,507	344,742	150,450	9,109,199	77,430
October	44,430	9,290,499	383,336	156,150	9,874,415	77,430
November	44,430	9,352,850	437,891	149,650	9,984,821	77,430
December	44,430	10,370,392	514,917	152,450	11,082,189	77,430
1945:						
January	44,430	9,990,927	529,471	154,650	10,719,478	77,430
February	44,420	8,185,344	563,833	147,350	8,940,947	77,430
March	44,420	9,373,015	509,279	122,850	10,049,564	77,430
April	42,920	7,825,931	385,579	209,760	8,464,190	77,430
May	42,920	7,669,326	380,615	229,380	8,322,241	77,430
June	39,920	6,375,084	262,411	225,300	6,962,715	77,430
July	39,920	5,925,737	251,308	229,220	6,446,185	77,430
August	34,900	4,022,710	148,992	37,000	4,243,602	37,830
September	34,900	350,166	85,000	10,000	480,066	37,830

TABLE 2.—Monthly kilowatt-hour load on each substation in Nagasaki district for 1945

Substation	January	February	March	April	May	June	July	August	September
Genoa	2,335,800	1,939,200	2,255,700	1,920,850	2,158,650	189,450	1,645,500	442,500	—
Yokami	1,379,870	1,315,910	1,166,790	1,278,080	1,301,470	1,055,820	1,169,130	312,100	—
Takemikubo	3,785,900	3,042,200	3,792,700	3,260,600	3,117,300	2,457,800	2,026,400	556,250	—
Hokoshima	2,794,570	2,042,510	2,146,630	1,791,290	1,734,150	1,708,720	1,870,000	209,340	849,290
Totopami	1,681,650	1,459,800	1,649,550	1,214,700	1,292,100	1,274,850	1,336,500	328,450	—
Izumi	701,440	661,860	858,140	649,700	610,400	425,600	368,340	372,310	255,260
Koyagishima	2,258,100	2,048,569	2,048,569	1,770,100	1,543,750	1,127,250	1,127,250	645,600	154,596
Isahaya	149,650	123,950	141,670	131,350	130,110	136,500	137,870	97,520	65,420

TABLE 3.—Distribution system damage table

Substation and feeder	Feeder length, miles			Line supports (poles)			Transformer			
	Total	De- stroyed	Re- paired	Total	De- stroyed	Re- placed	Total number	Total capac- ity (kilo- amperes)	De- stroyed number	De- stroyed capacity
Zenza:										
Shincho	18.0	0.93	0	781	23	1				
Daikoku	11.4	10.7	0	492	457	16				
Chuo	6.7	1.0	1.12	318	0	0				
Nisiyama	17.9	.93	.93	809	0	0				
Yagami	4.3	.93	.93	210	0	0				
Water course	2.1	.93	0	0	0	0				
Urakami	15.2	11.2	4	779	648	82				
Oura	14.8	1.0	1	668	0	0				
Electric Ry. Co.	.25	.25	.06	0	0	0				
Special contract	1.2	1.05	.25	35	23	11				
Saiwai Machi Arms	.5	.5	0	20	20	0				
Total	92.35	29.42	8.29	4,112	1,171	111	1,379	10,986.5	377	3,000.1
Urakami:										
Dozaki (torpedo test)	3.4	.19	0	0	0	0				
Nishiurakami	7.9	3.98	0	504	191	68				
Ohashi Arms Mfg.	.55	.56	0	25	25	0				
Testing basin	.19	.19	0	0	0	0				
Total	12.04	4.92	0	529	216	68	119	916.5	76	750.0
Takenokuko:										
Ohasi (Heiki)	1.0	1.0	0	0	0	0				
Steel foundry	.65	.65	0	19	13	0				
Total	1.65	1.65	0	19	13	0				
Mukoshima:										
Mitsubishi	0	0	0	0	0	0				
Mizunoura	.37	0	0	16	0	0				
Synchronous condenser	.43	0	0	20	0	0				
Mitsubishi Electric Mfg.	.75	0	0	13	0	0				
Inasa	10.0	.81	.19	504	86	19				
Kosakaki	4.2	0	0	286	0	0				
Akuren	1.1	.19	.19	51	5	5				
Total	16.85	1.00	.38	890	91	24	166	1,469.5	30	277.0
Egawa:										
Hayasikane	.93	0	0	10	0	0				
Kawanami	1.1	0	0	35	0	0				
General distribution	8.7	0	0	512	0	0				
Total	10.73	0	0	557	0	0	86	621.5		
Total	33.62	36.99	8.67	6,107	1,491	203	1,750	13,994.0	483	4,022.0

Note.—No destroyed transformers were replaced. Estimated number of man-days to repair damage, 5,794 (10-hour days).

Circuit	Location of damage	Kind and number of steel towers		Number of damaged poles		Con- crete poles damaged	Total length of line—miles	Form of poles		Remarks
		Concrete tower	Steel tower	Concrete pole	Steel pole			Dis- posed	Re- covered	
Nagasaki Switch to Zenza Sta- tion, No. 1 line, Nagasaki Switch to Zenza Sta- tion, No. 2 line, Nagasaki Switch to Mokoshima Station, No. 3 and 4 lines, Takenokubo branch line	Between stations 13 and 29	1	4	18	11	38	1,920	1.06		Damaged steel tower re- placed with pole H frame.
	Between stations 9 and 24			5	19	100	1,950	1.1	1.1	
	Between stations 10, 11, 22, and 26, No. 26 tower on Mukoshima line to Takenokubo Sta- tion,	2		48	0	60	6.85	.144	.586	Damaged steel towers re- placed with pole H frames. No repairs.
		5		5	0	60	.434	.434		

1 No steel or concrete supports recovered.

TABLE 6.—Gas holders

Gas holder No.	Capacity (cubic yards)	Type	Date of construction	Pressure in inches (water column)	Weight (tons)	Water volume (cubic yards)	Contents in Aug. 1945 (cubic yards)	Remarks
1	7,400	Double up-right cap.	December 1941	4.9 Up tank, 7.3 In tank	46 Up tank, 72 In tank	4,050	3,270	Total weight of tanks and structure, 220 tons. No oil was used in water seal. Location: Yachiyo Machi. Do.
2	7,400	do.	September 1923	do.	do.	4,050	3,270	Do.
3	20,000	Upright water seal, 14 col. 3-unit rising type.	April 1942	5.7 Up tank, 7.9 Md tank, 11.4 L tank	53 Up tank, 76 Md tank, 106 L tank	5,240	10,450	Total weight, 350 tons. 3.2 tons of oil were used in the water seal. Location: Ohashi.

TABLE 7.—Damage analysis—Yachiomachi Gas Works

Symbol	Name	Type	Capacity	Unit	Total	Extent of damage	Per cent	Cause	Restoration expenses (yen)	Man-hours for repairs	Remarks
A	Gas (inverter, etc.)	Horizontal riser	3,275 cubic yards (day)	Size	30,240 cubic yards (day)	Over house destroyed, riser set and its oil S.D.	100	Blust	100,000	6,000	Wooden structure. Charcoal power of gas 3,000 kilograms cal.
B	Waste heat boiler	Horizontal smoke tube type	7.8 feet	Diameter of shell	15.2 feet	Boiler room destroyed. Boiler brickwork S.D.	100	Blust	15,000	20,000	Wooden structure.
No. 1	Water condenser	Vertical water tube type	33,213 cubic yards (day)	Length of tube	42,782 cubic yards (day)	No damage	100	Blust	15,000		
C No. 2	do.	do.	9,260 cubic yards (day)	Number of tubes	75,801 cubic yards (day)	Machine house destroyed, exhauster slightly damaged.	20	Blust	20,000		do.
No. 1	Exhauster	Rotary 4 wing type	20,344 cubic yards (day)	20,344 cubic yards (day)	30,100 cubic yards (day)	Machine house destroyed, separator slightly damaged.	30	Blust	1,000		do.
E No. 2	do.	do.	26,100 cubic yards (day)	26,100 cubic yards (day)	13,700 cubic yards (day)	No damage	100	Blust			
T	Tar separator	Pekane condenser type	6,400 cubic yards (day)	6,400 cubic yards (day)	27,792 cubic yards (day)	No damage	100	Blust			
No. 1	Separator	Tower type	6,400 cubic yards (day)	6,400 cubic yards (day)		No damage	100	Blust			
No. 2	do.	do.	6,400 cubic yards (day)	6,400 cubic yards (day)		No damage	100	Blust			
No. 3	do.	do.	6,400 cubic yards (day)	6,400 cubic yards (day)		No damage	100	Blust			
W	Waste heat boiler	Louver type	27,792 cubic yards (day)	27,792 cubic yards (day)		No damage	100	Blust			

TABLE 8.—Damage analysis—Ohashi Gas Works

Symbol	Name	Type	Capacity	Unit	Total	Extent and damage	Per cent	Cause	Restoration expenses (yen)	Man-hours for repairs	Remarks
A	Gas producer	Horizontal riser through type	5,300 cubic yards (day)	5,300 cubic yards (day)	32,200 cubic yards (day)	Riser slightly damaged.	15	Blust	30,000		See plan photo.
B	Waste heat boiler	Horizontal smoke tube type	7.8 feet	Diameter of shell	15.03 feet	Brick work slightly damaged.	10	do	11,000		See plan.
C	Water condenser	Vertical water tube type	36,300 cubic yards (day)	36,300 cubic yards (day)	26,300 cubic yards (day)	No damage	100	Blust	Building 20,000		do.
E	Exhauster	Rotary 4 wing type	78,500 cubic yards (day)	78,500 cubic yards (day)	78,500 cubic yards (day)	Wooden machine building destroyed, exhauster slightly damaged.	10	Blust	Machine 5,000		do.
T	Tar separator	Pekane condenser type	65,300 cubic yards (day)	65,300 cubic yards (day)	30,200 cubic yards (day)	Separator slightly damaged.	10	do	1,000		do.
No. 1	Separator	Tower type	13,100 cubic yards (day)	13,100 cubic yards (day)	30,200 cubic yards (day)	Auxiliary equipment slightly damaged.	10	do	5,000		do.
No. 2	do.	do.	12,200 cubic yards (day)	12,200 cubic yards (day)	30,200 cubic yards (day)	do.	10	do	5,000		do.
P	Purifier	Dry system, water stand type	30,200 cubic yards (day)	30,200 cubic yards (day)	30,200 cubic yards (day)	do.	10	do	5,000		do.

TABLE 8.—Damage analysis—Ohai Gas Works—Continued

Symbol	Name	Type	Capacity		Extent of damage	Per cent	Cause	Restoration expenses (Yen)	Man-hours for repair	Remarks
			Unit	Total						
M	Station meter	Road type	653 cubic yards (hour)	653 cubic yards (hour)	Machine house destroyed	100	Blind	20,000		do.
H	Gas holder	Water tank hold, a lift system	13,100 cubic yards (hour)	13,100 cubic yards (hour)	Meter slightly damaged	10	do	100	40,000	See plan photo drawing.
G	Station governor	Elevator type	916 cubic yards (hour)	916 cubic yards (hour)	Inner holder destroyed	100	do	700,000	3,000	See plan.
No. 1	Compressor	Horizontal rotary type	1,860 cubic yards (hour)	1,860 cubic yards (hour)	Governor slightly damaged	10	do	500	3,000	do.
C					Compressor slightly damaged	10	do	1,000		
P No. 2			955 cubic yards (hour)	2,810 cubic yards (hour)						

TABLE 9.—Clean water reservoirs

Reservoir	Shape of basin	Size of basin (feet)	Depth (feet)	Capacity (million gallons)	Remarks
High	Rectangular	149.08 x 79.51	13.19	1,105,784	
	do	149.08 x 79.51			
	do	79.51 x 79.51			
Low	Circular	73.54 x 73.54	13.91	118,460	
	do	D—89.45			
High	Rectangular	D—86.46	15.42	65,100	
	do	77.01 x 77.01			
Low	Tunnel	77.01 x 77.01	12.43	117,910	
	do	High—16.56			
	do	Wide—15.09 x 377.20			
		Length—132		1,056,000	2 units.

TABLE 10.—Impounding reservoirs

Reservoir	Dam type	Height (feet)	Length (feet)	Effective capacity (million gallons)	Effective depth (feet)	Catchment area (square feet)	Detention height at full water (feet)	Area of full water (square feet)
High	Gravity type earth	54.68	416.56	95,040,000	45.23	37,649	282.08	548,790
Low	Gravity type concrete	74.55	377.20	160,512,000	55.66	7,801	200.08	494,960
High	do	104.37	455.92	388,080,000	92.63	49,399	295.20	1,495,640
Low	do	131.20	446.08	502,920,000	66.98	35,561	298.48	1,635,320
Kagakura	do	57.40	311.60	427,680,000		158,911	132.00	2,700,000

TABLE 11.—Filter beds

Reservoir	Number of beds	Size of beds (feet)	Depth (feet)	Filtration rate (gallons per square foot per day)	Rate of filtration (gallons per square foot per day)
High	3	Upper, 119.26 x 79.51 Lower, 100.37 x 61.63	11.87	8,339	10.92
Low	3	Upper, 129.20 x 99.38 Lower, 127.23 x 97.61			
High	3	Upper, 129.20 x 99.38 Lower, 127.23 x 97.61	9.34	12,707	8.86
Low	3	Upper, 119.26 x 99.38 Lower, 118.54 x 98.66			
	6	(1)	9.34	11,621	11.91
				5,650	293.00

These beds were not completed.
The projected capacity for the new filters.

Reservoir	Distance in miles from GZ	Planned maximum capacity in gallons per day	Average daily supply in gallons
Hongochi—high	3.7	2,452,032	1,236,048
Nishiyama—low	3.2	3,937,240	2,753,520
Nishiyama—high	3.4	3,938,240	2,533,608
Izumomachi	3.7	3,421,440	2,323,200
Urakami (projected)	2.0	7,128,000	1,848,000
Total		20,877,952	10,694,376

TABLE 13.—Damage to telephone equipment

Classification and equipment	Quantity or length in feet	Damage (percent)	Man-days to repair	Remarks
Inside plant:				
Subscribers' switchboard	43	0		Time of completion of repairs depends on the availability of materials.
Toll switchboard	36	0		
Motor generator sets	6	50	25	
Miscellaneous equipment		2	20	
Outside plant:				
Underground cable	59,600	2	300	
Aerial cable	216,400	80	12,000	
Local:				
Open wire	2,720,000	50	6,000	
Subscribers' telephones	16,000	60	3,600	
Underground cable	24,300	2	100	
Toll:				
Aerial cable	44,200	10	200	
Open wire	762,000	10	100	

TABLE 14.—Telegraph circuits from Nagasaki to points within the prefecture

Towns	Number of circuits	Type	Remarks
Sasebo	4	1 auto duplex	No. 1, No. 3, and all temporary circuits out of order since 25 July 1945.
Iwahasa	1	Sound simplex	Out of order since 15 Aug. 1945.
Fukue	1	do	
Shimahara	1	do	
Isahaya	1	do	
Nagasaki wireless station	2	do	No. 2 circuit out of order since 25 July 1945.
Tamanoura	1	do	do.
Omura	2	do	do.
Omoto	1	do	do.
Kuchinotsu	1	do	
Minami Arima	1	do	
Unzen	1	do	
Sakito Fukunoufa	1	do	

TABLE 14.—Telegraph circuits from Nagasaki to points within the prefecture—Continued

Towns	Number of circuits	Type	Remarks
Matsushima	1	Sound simplex	Out of order 25 July 1945.
Nagasaki	1	do	do.
Takushima	1	do	do.
Nagashima	1	do	do.
Nagasaki post office	3	1 sound duplex; 2 sound simplex	do.
Minoura Post Office	1	Sound simplex	do.
Shibuku Post Office	1	do	do.
Railway station	1	do	do.

TABLE 15.—Telegraph circuits to points outside Nagasaki prefecture

Towns	Number of circuits	Type	Remarks
Tokyo	2	Auto duplex, 1; printing duplex, 1	Out of order since 4 June 1945.
Osaka	3	do	No. 1 circuit out since 17 Sept. 1945; No. 2 circuit out since 6 July 1945; No. 4 circuit out since 17 Mar. 1945.
Kobe	2	do	No. 1 circuit out since 20 Dec. 1945; No. 2 circuit out since 27 June 1945.
Shimonoseki	2	Auto duplex, 1; printing duplex	No. 1 circuit out since 2 July 1945; No. 2 circuit out since 27 Aug. 1945.
Kanamoto	1	Auto duplex	Changed to sound duplex 25 July 1945.
Fukuoka	1	Printing duplex	Do.
Waji	1	Sound duplex	Out of order since 25 July 1945.
Naga	1	do	Changed to sound simplex 25 July 1945.
Kagoshima	1	do	Out of order since 25 July 1945.
Taketai	1	Sound simplex	do.
Omura	1	do	do.
Kanoto	1	do	do.
Yamato	1	do	do.
Fuku (wireless)	1	do	do.

Underwater cable lines

Fernosa Taihoko	2	Duplex	No. 1 out of order since 21 Dec. 1941; No. 2 out of order since 18 May 1945.
Dairen	1	do	Out of order since 17 Dec. 1942.
Manchuria	1	do	Out of order since 15 Aug. 1943.
Manchuria	2	do	Out of order since December 1941.
Vladivostok	2	do	Cable station located at Opakura with underground cable to Nagasaki formerly owned by Great Northern Co.



PHOTO 1.—4,600 feet from GZ. Third tower from Takenokubo Station on tap line from Zenza-Mukohina line.



PHOTO 2.—6,700 feet from GZ. Aerial view of 3,000-kilowatt steam-electric generating station.



PHOTO 3.—6,700 feet from GZ. Interior of boiler room, looking west, steam-electric generating station.



PHOTO 4.—6,700 feet from GZ. Interior view of boiler room, looking west, steam-electric generating station.



PHOTO 5.—6,700 feet from GZ. Side view of turbo-generator, looking west, steam-electric generating station.



PHOTO 6.—6,700 feet from GZ. Side view of turbo-generator, looking east, steam-electric generating station.



PHOTO 7.—5,400 feet from GZ. Aerial view, looking northeast, Zenze Substation.

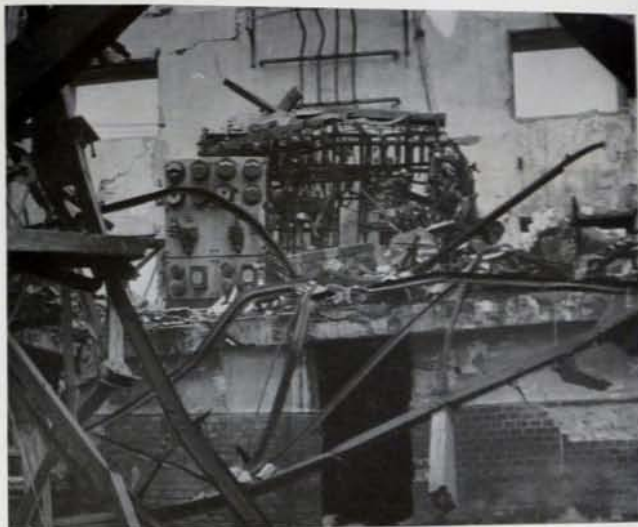


PHOTO 8.—6,700 feet from GZ. Switchboard and bus structure in east end of turbine room, steam-electric generating station.



PHOTO 9.—5,400 feet from GZ. East side view of transformers with blast walls at Zenza Substation.

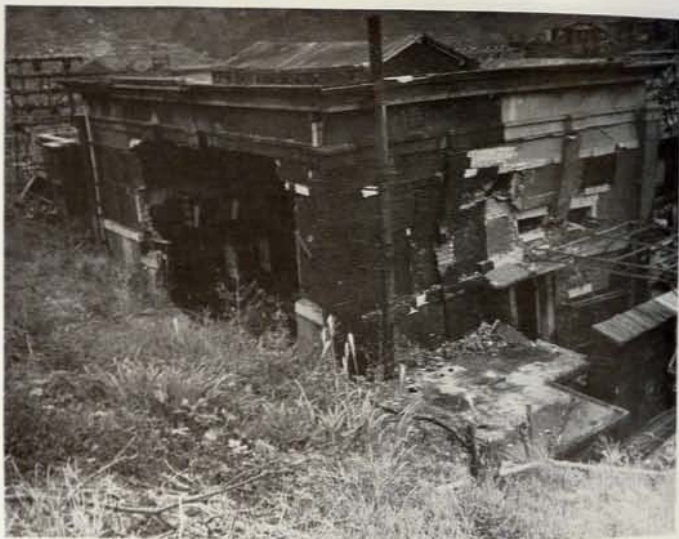


PHOTO 10.—5,400 feet from GZ. East and north sides of control and switch buildings, Zenza Substation.



PHOTO 11.—5,400 feet from GZ. Southeast corner of control and switch room, Zenza Substation.



PHOTO 12.—5,400 feet from GZ. Controls, 3.5-kilovolt busses and oil circuit breakers, Zenza Substation.



PHOTO 13.—3,600 feet from GZ. North end of control and switch building, Takenokubo Substation.



PHOTO 14.—3,600 feet from GZ. Interior view, northeast corner of control room (second floor), Takenokubo Substation.



PHOTO 15.—3,600 feet from GZ. Southeast corner synchronous condenser room, first floor, of switch building, Takenokubo Substation.



PHOTO 16.—3,600 feet from GZ. View of control room. Takenokubo Substation.



PHOTO 17.—3,600 feet from GZ. Wooden dirt filled blast walls on north side of transformers, Takenokubo Substation.



PHOTO 18.—3,600 feet from GZ. Blast wall separating transformer bays from high voltage switches. Wall blown over and tower in wall distorted. Takenokubo Substation.



PHOTO 19.—3,600 feet from GZ. View showing displacement and distortion of rack. Disconnect switch shown was originally over the bushing on the right. Takenokubo Substation.



PHOTO 20.—3,600 feet from GZ. Looking southwest through the rack at the distortion of main steel towers, Takenokubo Substation.

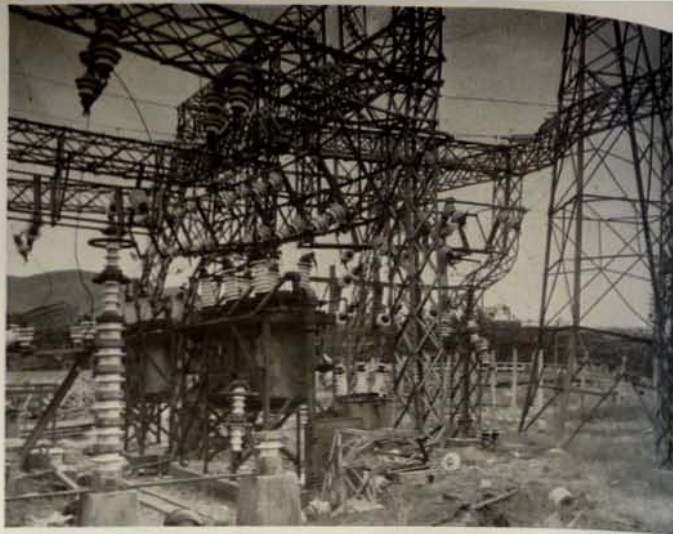


Photo 21.—3,600 feet from GZ. Looking southeast at distorted member supporting high voltage switch rack, Takenokubo Substation.

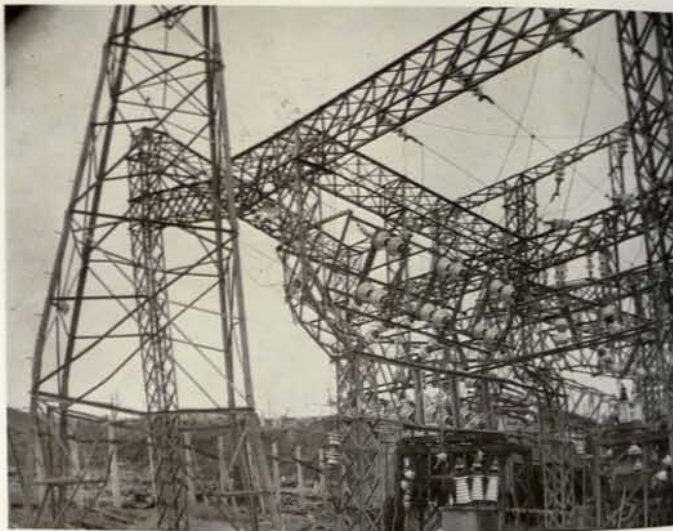


Photo 22.—3,600 feet from GZ. Distorted line tower and switch rack, Takenokubo Substation.



Photo 23.—3,600 feet from GZ. Three circuit copper bus structure. Note flash burns on poles. Takenokubo Substation.



Photo 24.—3,600 feet from GZ. Looking southeast at 3.5-kilovolt switch rack and first tower, Takenokubo Substation.



Photo 25.—3,600 feet from GZ. Looking northwest at 3.5-kilovolt switch rack, Takenokubo Substation.

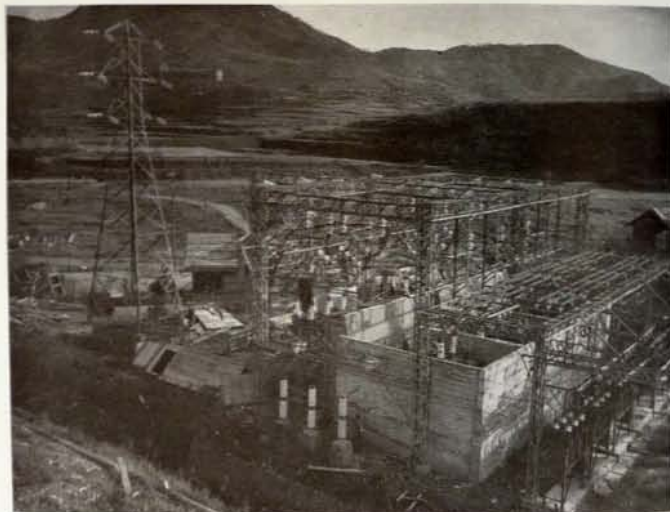


Photo 26.—5,200 feet from GZ. General view, looking southeast, Urakami Substation.

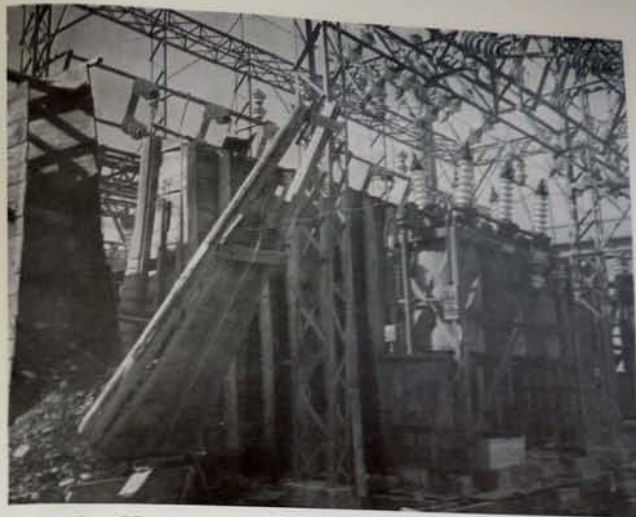


Photo 27.—5,200 feet from GZ. High voltage circuit breaker and blast walls on east and south side of transformers, Urakami Substation.

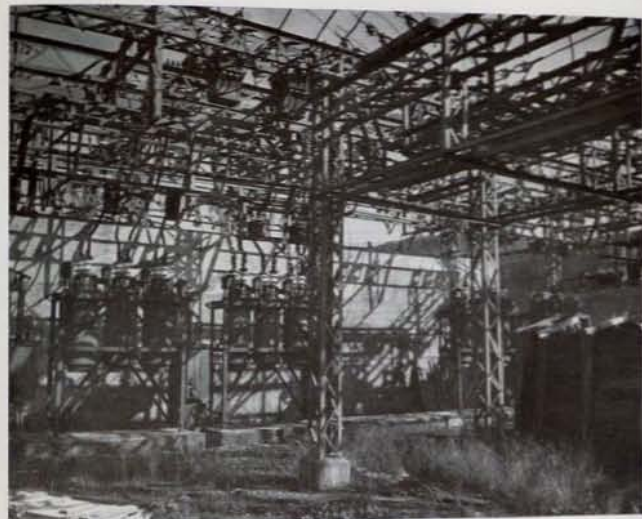


Photo 28.—5,200 feet from GZ. Blast walls and 3.5-kilovolt circuit breakers west of power transformer bank, Urakami Substation.



PHOTO 29.—5,200 feet from GZ. Remains of control building. Concrete structure was air-raid shelter for operators.
Urakami Substation.



PHOTO 30.—10,500 feet from GZ. Southeast corner of control building, Akunoura Substation.

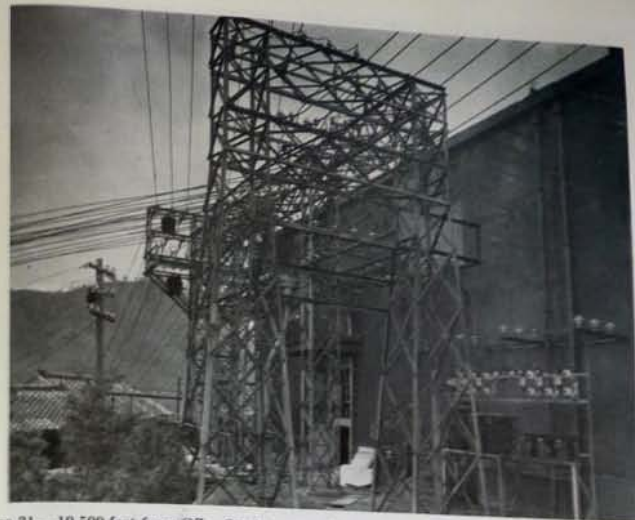


PHOTO 31.—10,500 feet from GZ. Steel tower and circuit entrance to building, Akunoura Substation.

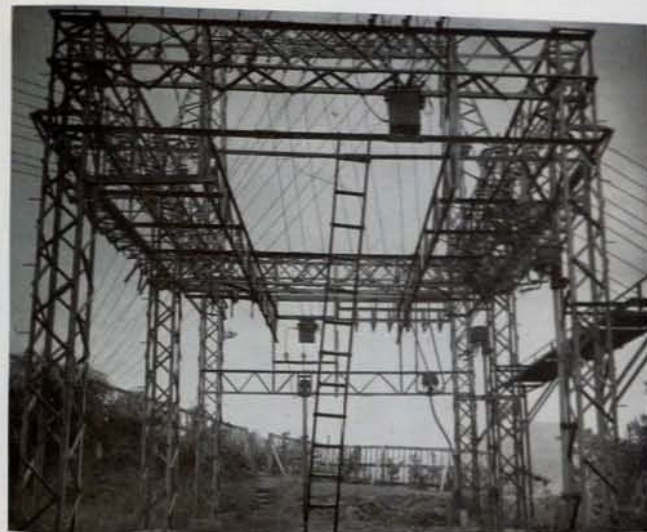


PHOTO 32.—10,500 feet from GZ. 3.5-kilovolt switch rack, Akunoura Substation.



PHOTO 33.—10,500 feet from GZ. General view showing incoming 66-kilovolt lines, rack and buildings, Akunoura Substation.

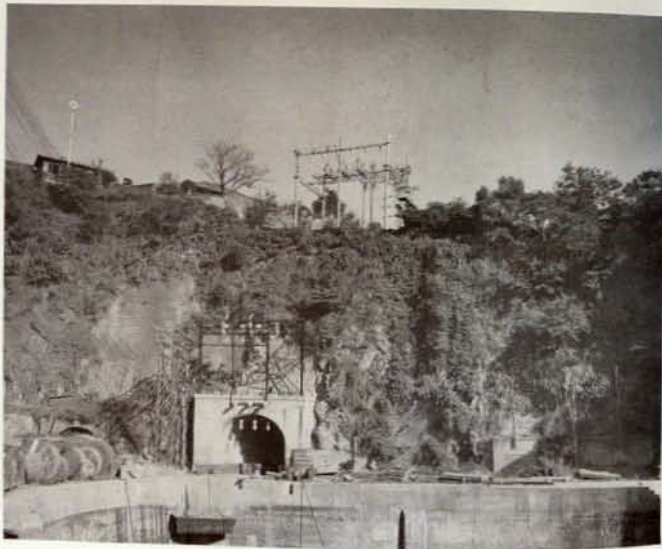


PHOTO 34.—12,500 feet from GZ. Racks and circuit entrance to Mukoshima underground substation.

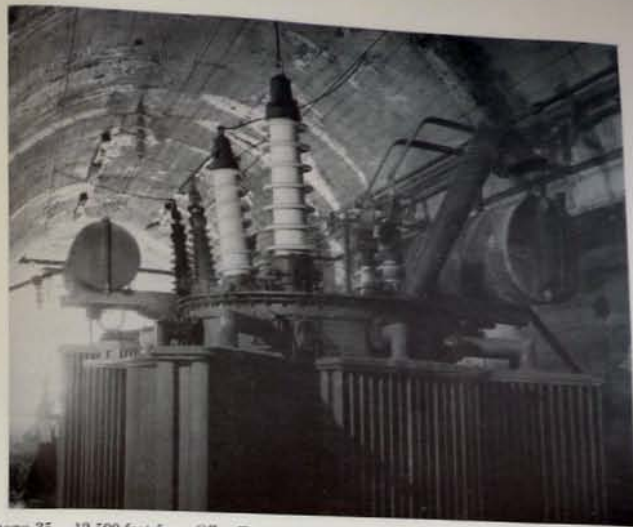


PHOTO 35.—12,500 feet from GZ. Transformers and high voltage buses, Mukoshima Substation.

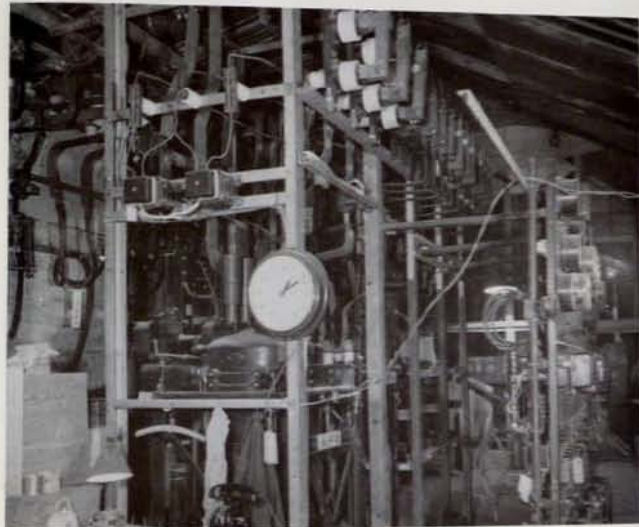


PHOTO 36.—12,500 feet from GZ. 3.5-kilovolt bus switch room, Mukoshima Substation.

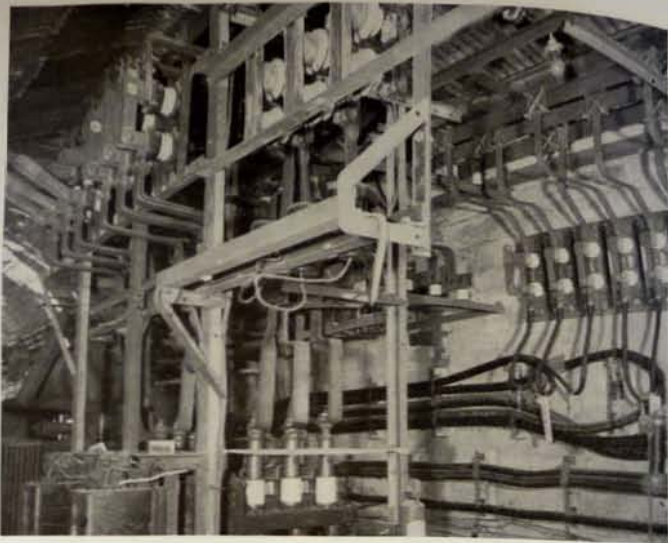


PHOTO 37.—12,500 feet from GZ. 3.5-kilovolt switches, busses, and cables. Mukoshima Substation.



PHOTO 38.—15,000 feet from GZ. Transformer bank and blast walls, Tategami Substation.



PHOTO 39.—15,000 feet from GZ. Entrance to underground transformer room (not completed).



PHOTO 40.—15,000 feet from GZ. Location of new underground transformer room with respect to the present station, Tategami Substation.



PHOTO 41.—15,000 feet from GZ. 3.5-kilovolt switch rack and circuit entrance to control building, Tategami Substation.

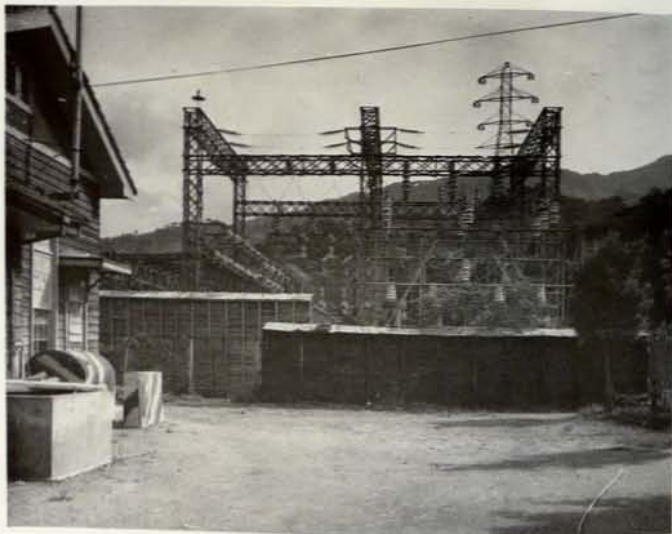


PHOTO 42.—30,000 feet from GZ. General view of south side, Egawa Substation.



PHOTO 43.—30,000 feet from GZ. General view of west side of substation, bus structure, and Egawa Substation.



PHOTO 44.—9,000 feet from GZ. Nagasaki 66-kilovolt switch station.



Photo 45.—6,600 feet from GZ. Aerial view of gas holders, Yachiyo-Machi Gas Works.

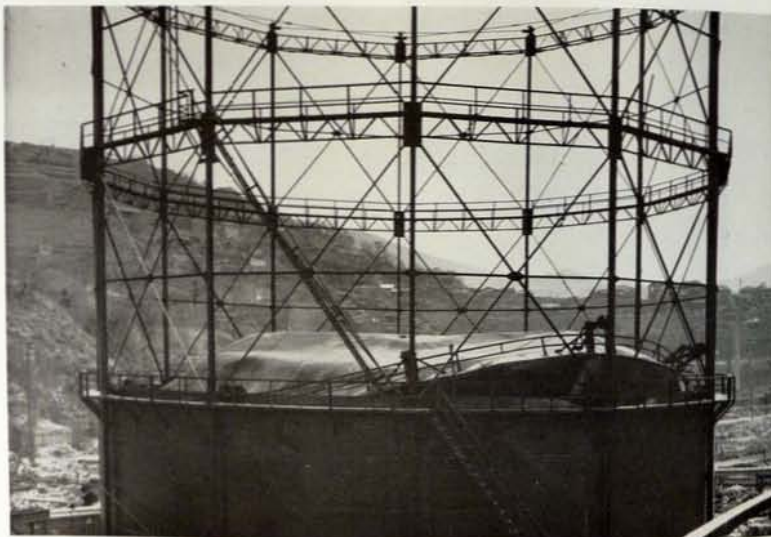


Photo 46.—6,600 feet from GZ. Gas Holder 1 showing damaged tank top, Yachiyo-Machi Gas Works.

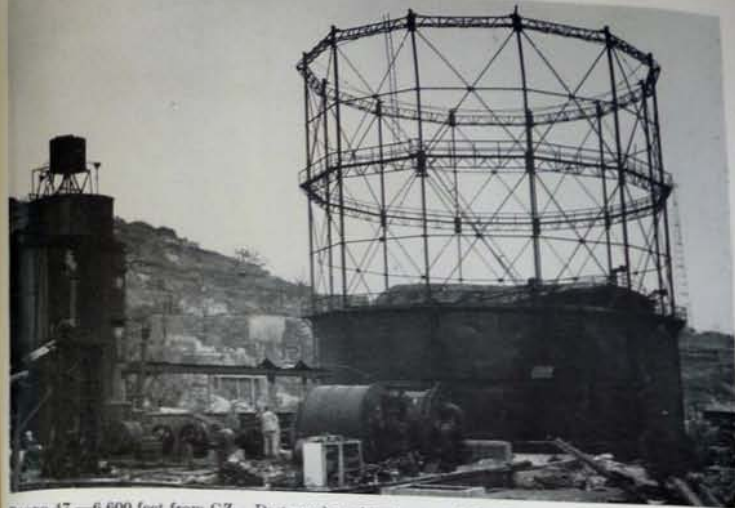


Photo 47.—6,600 feet from GZ. Destroyed machine house and Gas Holder 1, Yachiyo-Machi Gas Works.



Photo 48.—6,600 feet from GZ. Displaced guide roller on inner tank of Gas Holder 1, Yachiyo-Machi Gas Works.



PHOTO 49.—6,600 feet from GZ. Gas Holder 2 showing damaged tank top, Yachiyo-Machi Gas Works.



PHOTO 50.—6,600 feet from GZ. View of collapsed tank top, Gas Holder 2, Yachiyo-Machi Gas Works.



PHOTO 51.—6,600 feet from GZ. Detailed view of sheared tank top Gas Holder 1, Yachiyo-Machi Gas Works.



PHOTO 52.—6,600 feet from GZ. View of deformed tank top of Gas Holder 1, Yachiyo-Machi Gas Works.



PHOTO 53.—6,600 feet from GZ. Detail of gas retort, Yachiyo-Machi Gas Works.



PHOTO 54.—6,600 feet from GZ. View of machinery and scrubbers, Yachiyo-Machi Gas Works.

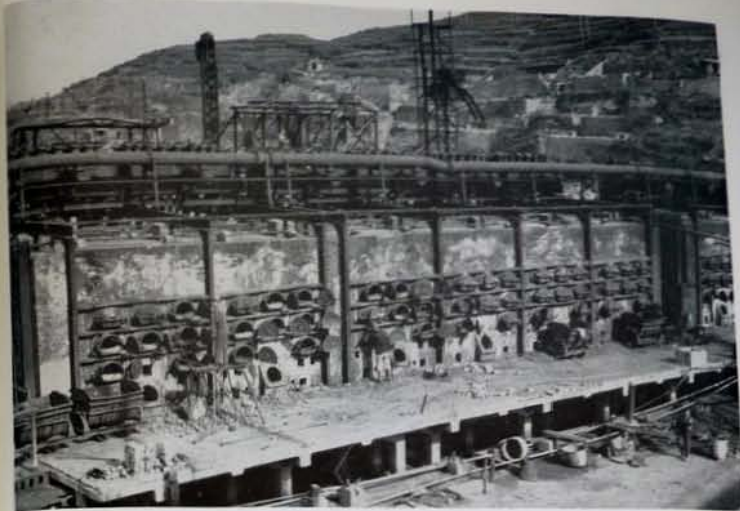


PHOTO 55.—6,600 feet from GZ. General view of gas retorts, Yachiyo-Machi Gas Works.



PHOTO 56.—6,600 feet from GZ. View of gas retorts, Yachiyo-Machi Gas Works.



PHOTO 57.—3,000 feet from GZ. Damaged tank structure, Chashi Gas Works.



PHOTO 58.—3,000 feet from GZ. Damaged tank top of gas holder, Ohashi Gas Works.



PHOTO 59.—3,000 feet from GZ. Detail of damaged gas holder, Ohashi Gas Works.



PHOTO 60.—3,000 feet from GZ. Deformed tank structure, Ohashi Gas Works.

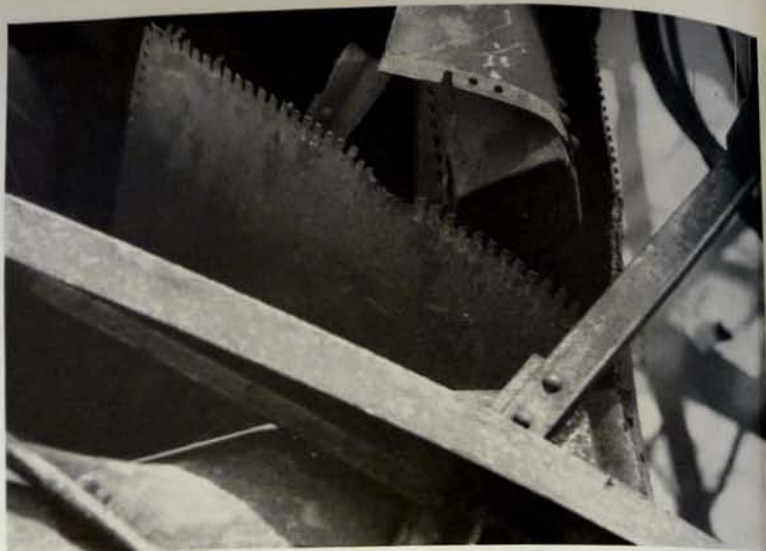


PHOTO 61.—3,000 feet from GZ. View of sheared rivet seams on gas holder, Ohashi Gas Works.

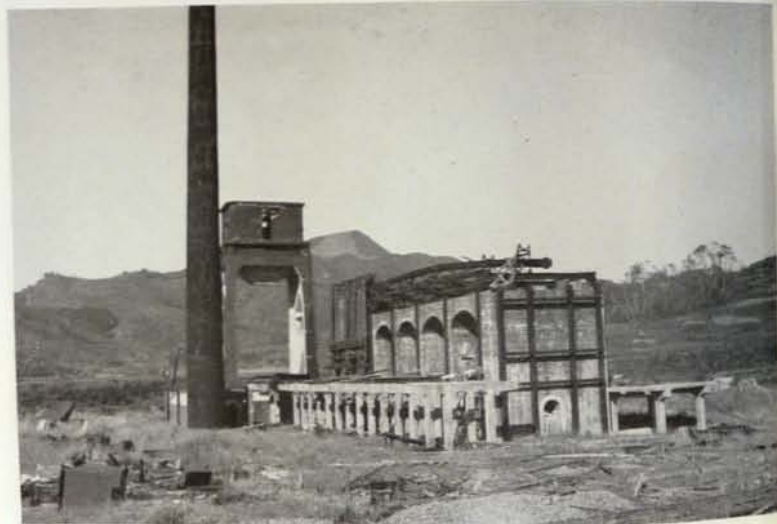


PHOTO 62.—3,000 feet from GZ. General view of gas retorts, Ohashi Gas Works.



PHOTO 63.—300 feet from GZ. Section of track damaged by fire.



PHOTO 64.—600 feet from GZ. General view of street car track. In foreground is overturned wood standard.



PHOTO 65.—450 feet from GZ. Damaged steel standards and wires for street railway. Note portion of car roof on standard.



Photo 66.—1,650 feet from GZ. Steel standard sheared by blast and thrown 7 feet in a northerly direction. car top.



Photo 67.—300 feet from GZ. Street car damaged by blast.



Photo 68.—840 feet from GZ. Damaged Bridge 26.



Photo 69.—1,750 feet from GZ. Damaged Bridge 8.

